UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

IN RE: NATIONAL PRESCRIPTION OPIATE LITIGATION	)	MDL No. 2804
	)	Case No. 1:17-MD-2804
THIS DOCUMENT RELATES TO ALL CASES	)	Hon. Dan A. Polster

Saturday, May 4, 2019

HIGHLY CONFIDENTIAL - SUBJECT TO FURTHER CONFIDENTIALITY REVIEW

Videotaped Deposition of MEREDITH B. ROSENTHAL, Ph.D., held at Robins Kaplan LLP, 800 Boylston Street, Suite 2500, Boston, Massachusetts, commencing at 8:04 a.m., on the above date, before Michael E. Miller, Fellow of the Academy of Professional Reporters, Registered Diplomate Reporter, Certified Realtime Reporter and Notary Public.

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DEPOSITION EXHIBITS
MEREDITH B. ROSENTHAL, Ph.D.
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DEPOSITION EXHIBITS

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PROCEEDINGS
(May 4, 2019 at 8:04 a.m.)
THE VIDEOGRAPHER: We're now on record. My name is Vince Rosica. I'm a videographer for Golkow Litigation Services. Today's date is May 4th, 2019 and the time is 8:04 a.m.
This video deposition is being held in Boston, Massachusetts in the matter of National Prescription Opiate Litigation, MDL No. 2804, for the Northern District of Ohio, Eastern Division Court. The deponent is Meredith Rosenthal.
Counsel will be noted on the stenographic record. The court reporter is Mike Miller and will now swear in the witness.
MEREDITH B. ROSENTHAL, Ph.D.,
having been duly sworn,
testified as follows:
EXAMINATION
BY MR. ROTH:
Q. Good morning, Professor Rosenthal.

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A. Good morning.
Q. My name is Martin Roth. We met off the record. I'll be taking your deposition here today.
Can you please state your full name for the record?
A. Meredith Beaven Rosenthal.
Q. And do you understand you're testifying under oath here today?
A. I do.
Q. And you've testified at depositions and in court and before Congress in the past?
A. I have.
Q. Approximately how many times altogether have you testified?
A. Perhaps 30 or 35.
Q. There's nothing that would prevent you from testifying truthfully here today?
A. There is not.
Q. If I ask you a question and you give me an answer, I'm going to assume you understood my question.
Is that fair?

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A. Yes.
Q. And if for some reason you don't understand one of my questions, you'll ask me for clarification?
A. Yes, I will.
Q. Okay. I'm going to start by marking as Exhibit 1 to your deposition your expert report, and I'm also going to simultaneously give you Exhibit 2, which is the errata sheet we received on Thursday night.
(Whereupon, Deposition Exhibit Rosenthal-1, 3/25/19 Expert Report, was marked for identification.)
(Whereupon, Deposition Exhibit Rosenthal-2, Errata to Expert Report, was marked for identification.)
BY MR. ROTH:
Q. So first, if you could look at Exhibit 1 and just confirm that that appears to be your expert report in this case along with Attachments A through D.
A. It is correct.
Q. And if you look at page 75, is that your signature on the report?

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A. Yes, it is.
Q. Exhibit 2 is a memo dated May 2nd from Forrest McCluer at GMA to yourself and Mr. Tom Sobol, your -- the attorney sitting with you; is that correct?
A. That's correct.
Q. And GMA is Greylock McKinnon?
A. That's correct.
Q. And who is Mr. McCluer?
A. Mr. McCluer is a senior economist there who worked with me on this matter.
Q. And I take it, given that Mr. McCluer went through the report to error check, that you believe that your report, along with the errata sheet, is accurate as of today?
A. I do.
Q. You didn't see any other errors that aren't contained in the errata?
A. I have not.
Q. And all of the opinions that you plan to give at trial in this matter are contained in your report as corrected by your errata?

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A. That's correct.
Q. Professor Rosenthal, you're a healthcare economist; is that correct?
A. Yes, that's right.
Q. You're not a medical doctor?
A. I am not.
Q. You're not an expert in the treatment of addiction?
A. I am not.
Q. You're not an expert in opioid use disorder?
A. I am not.
Q. And I looked at your CV. I don't think you've published on either addiction or opioid use disorder; is that correct?
A. I don't believe I have.
Q. You're not an expert in pharmacology?
A. I am not.
Q. You're not an expert in epidemiology?
A. I am not, although I do have some knowledge of epidemiology.
Q. You've reviewed epidemiological

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studies, but you're not an epidemiologist?
A. That's correct. An epidemiology class was required for my Ph.D., so I took an epidemiology class. I operate in the environment of public health research where epidemiology is an important strand that I frequently encounter, but I'm not an epidemiologist.
Q. And you're not a toxicologist?
A. I am not a toxicologist.
Q. You're not a pain management physician?
A. I am not.
Q. You don't diagnosis or treat pain?
A. No, I do not.
Q. You're not an expert in the FDA?
A. I am not an expert in the FDA, although, again, as you know, my work has frequently concerned FDA rules.
Q. But you've never worked for the FDA?
A. I have not.
Q. And you've never consulted a

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company regarding the meaning of FDA regulations or regulatory requirements?
A. I have not.
Q. You do understand that prescription opioids are FDA-approved products?
A. Yes, I do.
Q. And, in fact, if you look at your report, at paragraph 19, which is the bottom of page 15. Let me know when you're there.
A. Yes.
Q. You acknowledge that since 1962 the FDCA and related regulations have required sponsors of new drug products to present scientific evidence of both efficacy and safety before a new product can be marketed.
Do you see that?
A. Yes, I do.
Q. And you cite to the FDA website when you write that?
A. That's right.
Q. And then turning the page, you say in paragraph 20: By regulation,

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prescription drug labels indicate the diseases, conditions and/or patients for which the sponsor has presented scientifically required evidence to the FDA.
Right?
A. Yes, that's what it says.
Q. And for that proposition, you cite to a number of federal regulations in footnote 31?
A. I do.
Q. You're not an expert on drug labeling.
A. I am not.
Q. In paragraph 21 of your report, you say: FDA regulations specify that promotional materials may only make claims that are supported by scientific evidence, i.e., supported by studies meeting scientific standards, and they may not be false or misleading.
Did I read that correctly?
A. You did.
Q. And you're not an expert on FDA regulations, are you?
A. I am not.

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Q. And then in paragraph 22 you say: FDA oversight of drug promotion is intended to ensure that physicians and consumers understand both the benefits and risks of a drug. FDA regulations call for fair balance in all promotional claims and materials. The risks as well as the benefits must be clearly identified and risks must be given appropriate prominence.

Do you see that?

A. Yes, I do.

Q. And there's another citation to a Code of Federal Regulations section for that paragraph, correct?

A. Yes.

Q. You understand that the FDA regulates labeling for prescription drugs, based on what you've said in your report?

A. I do.

Q. And the FDA approves prescription drugs even if they have known risks?

A. Yes.

Q. Do you understand that the FDA also regulates promotional materials for

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prescription drugs?

MR. SOBOL: Objection.

A. Yes, I do.

BY MR. ROTH:

Q. And the FDA has authority to police advertising that it believes would result in prescription drugs being misbranded under the federal regulations?

MR. SOBOL: Objection.

A. I'm not sure exactly what you mean by "police," but as I've described in my report, I understand that materials are reviewed by the FDA.

BY MR. ROTH:

Q. And the FDA has the authority to tell a drug manufacturer to either modify or refrain from using materials that it may review?

A. I just want to be careful that I don't try to convey any legal expertise here, but I am aware that the FDA, for example, issues warning letters pertaining to specific marketing tactics and messages. If that's what you're referring to then, yes, I understand that.

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Q. Well, more than warning letters, the FDA may tell a manufacturer when it reviews draft promotional materials, for example, that it does not approve their dissemination.

Are you aware of that?

MR. SOBOL: Objection, asked and answered.

A. I guess I would have thought of that as similar -- again, not being a legal expert -- similar to those warning letters that say that you may not do this. The specifics of how the enforcement flows after that, what the FDA can and can't do in terms of enforcement, I'm a little less clear on.

BY MR. ROTH:

Q. Okay. And I appreciate that you're not a legal expert, but do you understand that in addition to issuing warning letters after materials may have gone out, the FDA, sometimes before materials are utilized, may give input and feedback to manufacturers about the materials that they plan to use?

A. Yes, I believe that's true.

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Q. And you did not study which, if any, of the promotional materials for prescription opioids were submitted to FDA for its review before they were used?

MR. SOBOL: Objection.

A. I did not study that, no.

BY MR. ROTH:

Q. And you did not study which of the detailing contacts in your regression models, which we'll talk about, involve promotional materials that had been submitted for FDA review?

MR. SOBOL: Objection.

A. I did not, no.

BY MR. ROTH:

Q. Do you agree that opioids have legitimate medical uses for certain diseases and conditions?

A. Yes, I would say that's true. According to their label, yes.

Q. And you understand that the FDA has approved opioids for certain of these conditions in their labels?

A. Yes, I understand that the approved labels include those conditions for

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which the FDA has deemed them appropriate.
Q. Did you review any drug labels in connection with your work in this case for prescription opioids?
A. I have looked at some of the drug labels, yes.
Q. Do you recall which drug labels you reviewed?
A. I believe for OxyContin and hydrocodone.
Q. Did you review any labels beyond that that you recall?
A. Not that I recall.
Q. And I've looked at Attachment B. I don't think I saw drug labels on your reliance list; is that correct?
A. That's correct.
Q. Do you understand that prescription opioids are approved in their labels for the treatment of chronic pain?
MR. SOBOL: Objection.
A. As I sit here, I couldn't tell you which drugs have approvals for chronic pain on their labels, no.

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BY MR. ROTH:
Q. Do you recall whether the OxyContin and hydrocodone labels you reviewed contained approvals for chronic pain for those drugs?
MR. SOBOL: Objection, scope.
A. I do not.
MR. SOBOL: Just give me a little bit of a chance to get my objections in, Professor. Just a nanosecond.
A. I do not recall.
BY MR. ROTH:
Q. Have you ever taken a prescription opioid before?
A. I have not.
Q. Have you reviewed any medical literature or guidelines on which uses prescription opioids are FDA approved for?
A. In the context of my report, I discuss some of the guidelines, so I -- and I've certainly reviewed those, for example, the CDC guidelines. I don't know if that's what you're referring to. I'm not specifically myself offering an opinion on

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those guidelines. As you know, as we just discussed, I'm not a clinical expert or a pharmacologist, but I'm certainly aware of guidelines that talk about the appropriate uses of opioids.
Q. Do you know the most common uses of opioids for which health insurers and federal Medicare or state Medicaid agencies reimburse use?
MR. SOBOL: Objection.
A. As I sit here, do I know which uses are most prevalent across all those payors? No. No, I do not.
BY MR. ROTH:
Q. Do you know whether Medicare, for example, reimburses patients for the use of prescription opioids for the treatment of chronic pain?
MR. SOBOL: Objection.
A. Well, I think you would be talking about Medicare Part D. Just to be clear, those are private insurers that are acting in the service of Medicare beneficiaries, and each, of course, has a different formulary and may use different

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mechanisms to ensure appropriate drug use.
So I think it would be hard to characterize that as Medicare as a whole.
BY MR. ROTH:
Q. Do you know whether any of the Medicare Part D insurers approve the use of opioids on their formularies for the treatment of chronic pain?
MR. SOBOL: Objection.
A. I do not know one way or the other. I do not believe that -- I do not know one way or the other whether there are restrictions relative to the uses of particular drugs for particular indications.
BY MR. ROTH:
Q. Okay. I'm going to mark as Exhibit 3 to your deposition a document that I pulled from your reliance list. It's titled Medicare Program Policies and Procedures, and it was linked to the Excellus Blue Cross Blue Shield page.
(Whereupon, Deposition Exhibit Rosenthal-3, Medicare Program Policies & Procedures, was marked for identification.)

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BY MR. ROTH:
Q. Do you see that document?
A. I do.
Q. And do you recognize this document as one that you reviewed?
A. I do.
Q. Okay. So why did you have your team pull this document and why did you review it in your work in this case?
A. I'd actually have to look in my report to see what I cite it for specifically.
Q. Okay. If you look on the first page, it says: Summary of Formulary Level Opioid POS for Calendar Year 2019.
Do you see that?
A. I do. And just to be clear, this is a single Medicare Part D carrier. This is not official Medicare policy per se.
Q. Right.
A. But yes.
Q. So if you look at page 3 of this document, it talks about the review criteria for Blue Cross Blue Shield for opioid, seven-day supply limits.

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Do you see that?
A. I do.
MR. SOBOL: Objection.
BY MR. ROTH:
Q. And then the first bullet -- or it says before the bullets: An exception to the seven-day quantity limit of a shorter long-acting opioid may be permitted in patients who meet one of the following criteria, A through F below.
Do you see that?
A. I do.
Q. And then the first bullet says: Approval will be a 30-day override for scenarios A, B, C, D and E below.
And then there's a second bullet below that. Do you see that?
A. Yes.
Q. And it says: Approval will be a 30-day override for scenario F below.
Do you see that?
A. I do.
Q. And then under that bullet is E where it says: The requesting physician provides a supporting statement/attests that

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a prescription for greater than a seven-day supply is medically necessary to manage the patient's pain.
Do you see that?
A. I do.
Q. And so at least for Blue Cross Blue Shield, it appears in their formulary they have a mechanism for approving the use of opioids to treat pain for longer than seven days?
MR. SOBOL: Objection. Blue Cross Blue Shield of? Question mark.
THE WITNESS: Are you waiting for me to answer your question?
MR. ROTH: I was.
A. This -- in this Excellus formulary, they do indicate -- obviously this is 2019. They do indicate that mechanism. You had asked me before about chronic pain. I don't know if you're trying to infer that anything longer than seven days is chronic. I think that's not exactly the definition of chronic pain, so...
BY MR. ROTH:
Q. We'll get there.

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A. Okay.
Q. I promise.
MR. SOBOL: I'll write that down.
BY MR. ROTH:
Q. Your direct and indirect regressions do not make any attempt to differentiate legitimate prescriptions from medically unnecessary ones; is that correct?
MR. SOBOL: Objection.
A. The goal of my analysis is to examine the impact of the alleged misconduct, and so I appropriately quantify all prescriptions caused by the alleged unlawful marketing.
BY MR. ROTH:
Q. You're not an expert in pharmaceutical marketing practices, correct?
A. I am not an expert in pharmaceutical marketing practices, although, again, I have studied pharmaceutical marketing and its effects and so I have a high degree of familiarity.
Q. But you're not opining on which of defendants' marketing practices were

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unlawful?
A. That's correct. I have been asked to assume that the marketing practices during the period from 1995 through the end of my data were unlawful.
Q. And do you rely on anything besides counsel's instruction to you to make that assumption?
A. Well, as you can see in my report, I have reviewed documents, testimony from other experts. I understand the context in which the alleged misconduct took place, and so I have examined that assumption using my expertise.
Q. But you're not offering an opinion as to whether that assumption is correct, or not?
A. I am not offering an opinion about that assumption, no.
Q. And one of the sources you relied on to test the instruction that all of defendants' misconduct was unlawful was Dr. Perri; is that right?
A. Yes, he is one of the other experts I refer to.

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Q. And are you aware that Dr. Perri testified last week that he didn't evaluate whether defendants' marketing was lawful or appropriate?
MR. SOBOL: Objection.
A. Well, Dr. Perri is not a lawyer, so I would not expect him to deem anything lawful. He describes how defendants' marketing efforts work, the extent to which they conformed with standard marketing practices, the extent to which he deemed them appropriate as a pharmaceutical marketer, as opposed to unlawful.
BY MR. ROTH:
Q. So there's no expert that you're relying on that makes that legal conclusion as to whether defendants' marketing was lawful or not. Is that your understanding?
A. I'm relying on instructions from counsel about the -- is lawfulness a word? About the legality of the connect conduct in question.
Q. You're relying on counsel's confidence that they can prove that all of

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defendants' marketing was unlawful when they try their case some day?
MR. SOBOL: Objection.
A. I'm relying on instructions from counsel, yes.
BY MR. ROTH:
Q. You're not an expert on the DEA?
A. I am not an expert on the DEA.
Q. And you're not an expert in suspicious order monitoring?
A. I am not.
Q. Your analyses do not attempt to attribute any causality to opioid manufacturers or distributors for alleged suspicious order monitoring deficiencies, correct?
A. I'm sorry. Could you just repeat that question? There was a lot there.
Q. Your analyses do not attempt to attribute any causality to opioid manufacturers or distributors for alleged suspicious order monitoring deficiencies?
A. No, my analysis does not attribute causality related to those

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distributors.
Q. And, in fact, your analysis does not attempt to attribute any causality to distributors or pharmacies for any activities that they conducted related to the opioid issue?
MR. SOBOL: Objection.
A. I was not asked to examine issues of causality related to the nonmarketing defendants. Is it okay if I use that term, "marketing defendants," to describe what is in my report?
BY MR. ROTH:
Q. I'll use a different term if I need to, but I understand what you're saying.
A. Okay.
Q. You're not an expert in the diversion of drugs for illicit use?
A. I'm not an expert in diversion, no.
Q. And your analyses do not attribute any causality for the -- what you call the opioid epidemic to criminal diversion or drug cartels?
A. I have not examined the

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question of causality related to diversion and criminal activity.
Q. Your analyses do not attribute any causality to government agencies for approving opioids for certain medical uses --
MR. SOBOL: Objection.
BY MR. ROTH:
Q. -- in the scope of the opioid epidemic?
MR. SOBOL: Objection.
A. I have not tried to examine -- I guess I'm not entirely sure what that analysis would look like, but I have not tried to examine the effects of specific scope -- of the scope of approval for opioids and whether it had been different, whether the results would have been different.
BY MR. ROTH:
Q. Okay. If you turn to paragraph 6 of your report, you describe the allegations in the bellwether complaints.
Do you see that?
A. Yes.
Q. You say: I understand that this litigation brought by the City of

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Cleveland, the City of Akron, Cuyahoga County and Summit County, collectively the bellwether governments, alleges -- and then it goes on.
Do you see that?
A. Yes.
Q. Do you understand that the City of Cleveland and the City of Akron are not bellwether plaintiffs at this time?
A. I do understand that.
Q. And then when you describe what the complaints say, you say: The bellwether governments allege, among other things, that the defendants' conduct in promoting opioid use, addiction, abuse, overdose and death has had severe and far-reaching public health, social services and criminal justice consequences, including the fueling of addiction and overdose from illicit drugs such as heroin.
Do you see that?
A. I do.
Q. And then you go on to say: The governments further allege that the opioid epidemic and the need for increased services

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arose from the opioid manufacturers' deliberately deceptive marketing strategy to expand opioid use, together with the distributors' equally deliberate efforts to evade restriction on opioid distribution.
Do you see that?
A. I do.
Q. Who are the manufacturers you're referring to in paragraph 6?
A. The manufacturers who are the defendants in this matter who marketed any of the drugs at issue here.
Q. And what is the misconduct that you're referring to in paragraph 6 that those manufacturers engaged in?
A. Its allegedly unlawful marketing, deceptive marketing of opioids.
Q. And what do you understand that deceptive marketing strategy to include?
A. That deceptive marketing strategy includes classical marketing tactics such as detailing which we'll no doubt discuss later is the most prominent form of marketing in this sector, as well as so-called unbranded advertising, which may

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come in the form of patient information, payments made to patient and professional organizations that created guidelines around the use of opioids for pain. All of those tactics that I describe in greater detail in my report.
Q. And who are the distributors you're referring to in paragraph 6?
A. The distributors are McKesson, AmerisourceBergen. And there's a third, I'm sorry, memory test on the defendants that I did not look at. At the moment the third one is escaping me.
Q. When you refer to the distributors' deliberate efforts to evade restriction on opioid distribution, what are you referring to?
A. Well, again, here, as you see, I'm quoting the complaint, and I understand that the distributors have an obligation to prevent so-called suspicious orders.
Q. And you didn't evaluate or analyze how the distributors complied with those obligations and how that might affect causality; is that correct?

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MR. SOBOL: Objection. Objection, asked and answered.
A. I did not evaluate the distributors' conduct, no.
BY MR. ROTH:
Q. So your models provide no analysis of causation by distributors or pharmacies for what plaintiffs allege is the opioid epidemic, correct?
MR. SOBOL: Objection, asked and answered.
A. The distributors' conduct was outside the scope of my report.
BY MR. ROTH:
Q. I want to take a look at the complaints you site in footnote 18 and 19. I assume you looked at those complaints?
A. I did.
Q. Okay. So I'm going to mark as Exhibit 4...
A. That is clearly not the whole complaint because I happen to know that it's several inches thick.
Q. Correct. You're right. I'm going to mark as Exhibit 4 just the cover

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page and the paragraph I want to ask you about, from the Second Amended Complaint filed by Summit County.
(Whereupon, Deposition Exhibit Rosenthal-4, Second Amended Complaint and Jury Demand, was marked for identification.)
BY MR. ROTH:
Q. Do you have that in front of you?
A. I do.
Q. And if you look at paragraph 10, which I excerpted from the complaint. Do you see it?
A. Yes.
Q. It says: On the demand side, the crisis was precipitated by the defendants who manufacture, sell and market prescription opioid painkillers, defined as the marketing defendants.
Do you see that?
A. I do.
Q. And then it says: Through a massive marketing campaign premised on false and incomplete information, the marketing

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defendants engineered a dramatic shift in how and when opioids are prescribed by the medical community and used by patients.
Do you see that?
A. I do.
Q. What do you understand to be the false and incomplete information that the alleged marketing campaign was premised on?
A. There are a number of components. At a high level, the main issue as I understand it as a health economist, not as a clinician, is -- was the -- that it was conveyed to physicians and to the public that opioids were safe; that the possibility of addiction was relatively low; that these drugs were effective, not just for cancer pain, but for a wide variety of acute and chronic pain.
And then there were other messages that were conveyed that supported those general premises, including the fact that extended release formulations of opioids would smooth out the peaks and valleys of pain control; that as patients became tolerant to these drugs, that this was a

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natural phenomenon and not a sign of addiction.
There were certain notions such as pseudoaddiction that were promoted through communication by the marketing defendants. And at the same time, it was also conveyed that physicians could identify some small group of patients who might be more likely to abuse opioids and prevent and control abuse, that this was an issue related to the individual characteristics and not to the products themselves.
Q. Okay. What analysis did you do to test whether the detailing visits you analyzed communicated that false and incomplete information as you just described it during those visits?
A. Well, I think you misunderstand the entire premise here. As I noted earlier, detailing, while it is the promotional tactic that I can best measure and use in my analysis, the allegations suggest that this campaign of misinformation permeated through many other vehicles.
And so it's not in my view,

again, as a health economist, a question of ascertaining what was in a particular detail, but what was available in -- through key opinion leaders, what was available through professional guidelines, all of that setting the context. So it's not so much about looking for one co-mission as a much broader picture of what the information was that was conveyed.

Q. Okay. You've testified as a causation or damages expert before, correct?

MR. SOBOL: Objection.

A. I have.

BY MR. ROTH:

Q. And in general, you understand that to opine on causation or damages, you have to tie the theory of liability to damages?

MR. SOBOL: Objection.

A. Yes, and I have done that in my report.

BY MR. ROTH:

Q. Okay. The complaint defines a theory of liability here as false and incomplete information, correct?

A. Yes, correct.

Q. What have you done to confirm that the detailing visits you analyzed actually contained false and incomplete information as the complaint or you define it?

MR. SOBOL: Objection, just asked and answered.

A. As we talked about earlier, I've been asked to assume that counsel will prove that all or virtually all marketing during the period from 1995 to the end of my data was unlawful.

So I have tested the reasonableness of that assumption in the review of the documents that we've talked about, in the review of other expert opinions.

I have not, nor do I believe it's necessary to make that causal step, looked at individual details throughout the period for my analysis.

BY MR. ROTH:

Q. You would agree that detailing in and of itself is not unlawful?

MR. SOBOL: Objection.

A. Well, again, if that detailing is conveying false and misleading information, I understand -- I'm not a lawyer, but I understand that it would be unlawful. And so, you know, I do not -- I am not making an assumption that detailing in general is unlawful but that this detailing can be proved to be unlawful.

BY MR. ROTH:

Q. A pharmaceutical rep going to a doctor to drop off a pizza could be considered a detailing visit, correct?

MR. SOBOL: Objection.

A. A detailing visit generally involves the conveyance of some information, maybe a pizza in addition, but the details that I'm looking at, there is a specific product mentioned.

BY MR. ROTH:

Q. But detailing visits can take many forms, correct?

MR. SOBOL: Objection.

A. Well, I'm not sure exactly what you mean by it. There's information conveyed

about a product or a set of products, and detailing visits are face-to-face visits between the salesperson and someone in the physician's office.

BY MR. ROTH:

Q. But you know that detailing could just be the sales rep dropping off a placard with the product's label on it?

MR. SOBOL: Objection.

A. I think you misunderstand, again, the interconnectedness of all of this. And so if a detail were something like you just described -- I don't know about a placard, how about a coffee mug -- those details are intended to reinforce messages that have been conveyed in previous details that have been conveyed by key opinion leaders.

I don't think it's appropriate to pull these individual pieces out as if they were not part of an integrated marketing scheme, which is really precisely what Dr. Perri talks about in his report.

BY MR. ROTH:

Q. But you're not offering the

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opinion that every time a sales rep detailed a doctor for an opioid product, that was unlawful?

MR. SOBOL: Objection.

A. I am not offering any opinion about the unlawfulness of detailing, as we have spoken about before. I was asked to assume that plaintiffs' counsel would prove that marketing was unlawful.

BY MR. ROTH:

Q. We'll come back to this, but I'll give you a break from it.

If you look back at paragraph 7, you say in paragraph 7 of your report -- sorry: In this report I refer to the manufacturers' deceptive marketing strategy and tactics as manufacturer misconduct. This report does not address nonmarketing misconduct.

Do you see that?

A. Yes.

Q. What is your definition of nonmarketing misconduct?

A. By that, I mean to describe misconduct related to identifying and

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intervening with suspicious shipments, the distributor misconduct, as I understand it, yes.

Q. Okay. And then in paragraph 8 you say: My assignment is to answer the following questions framed by plaintiffs' counsel.

Do you see that?

A. I do.

Q. And each of the bullets is bounded -- I guess with the exception of the sensitivity -- each of the first three bullets is bounded by the year 1995.

Do you see that?

A. Yes.

Q. So since 1995 I'm going to look at causation.

Can you explain why 1995 was selected?

MR. SOBOL: Objection.

No discussions with counsel, but if you have a general understanding, that's fine.

A. My general understanding is that counsel for plaintiffs intend to prove

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that marketing since 1995 was unlawful.

BY MR. ROTH:

Q. Do you have any independent understanding as to why that would be a good measuring date?

A. As I sit here specifically, no. It will get into the specific facts that I describe in my report in terms of what is happening in opioid prescribing in the world in 1995, and that is certainly a turning point in the -- in opioid use, as you can see from the sales data I have.

Q. Is there a specific event that happened in 1995 that you believe was the start of the unlawful marketing scheme alleged in the complaint?

A. As I sit here, I can't think of anything specifically, no.

Q. Okay. I'm sure we'll talk about this later, but I know from sitting through Professor McGuire's deposition and Professor Cutler's deposition, that as Professor McGuire described it, there was a triumvirate of damages experts in this case?

A. Quadrumvirate.

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Q. If you include Professor Gruber?

A. Yes.

MR. SOBOL: You can't forget John.

BY MR. ROTH:

Q. So you understand, I take it, that Professor Cutler calculates harms beginning in 2006?

A. Yes.

Q. And did you review his report before finalizing your report?

A. Before finalizing my report, I believe I did.

Q. And you had conversations with him about your models and I assume about his models as well?

A. With counsel present, we talked about the work as a whole.

Q. Okay. Do you know why calculating a harm from 2006 forward as he does requires looking at misconduct dating back to 1995?

MR. SOBOL: You can answer only if it's not based on counsel.

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A. Based on my understanding of the economic phenomena of interest, yes. So, as I'm sure we will discuss and you know, my model examines the effects of marketing over time, and marketing has long-lasting effects. So what happened in 1995 is still affecting the world in 2006.

Moreover, of course, harms such as overdose deaths are lagged somewhat to the start of someone's experience taking an opioid. So it's important to take a look at the entire time period.

BY MR. ROTH:

Q. And we will talk about the stock of promotion and how you calculate that.

But the way you calculate that, if you started back in 1990 or 1985, it would still have an impact on 2006; isn't that right?

MR. SOBOL: Objection.

A. What's important is when the but-for marketing departs from actual marketing, so that is why those earlier periods matter and going back to 1985

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wouldn't matter because but-for and actual marketing are the same.

BY MR. ROTH:

Q. And the reason you say but-for and actual marketing are the same is the assumption that the scheme started in 1995?

MR. SOBOL: Objection.

A. Yes, the assumption that I used to calculate but-for marketing is that the defendants' marketing after 1995 was unlawful.

BY MR. ROTH:

Q. You have not done any analysis of causation as to non-defendant manufacturers; is that correct?

MR. SOBOL: Objection.

A. Well, my model includes all opioids in this category. We can talk about I exclude the injectables. There's some exclusions.

But I examined the effect of marketing on sales beyond the defendants, so I provide causal estimates of the effective marketing on sales for non-defendants. And then separately, again, I'm sure we will get

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to this, I break out non-defendant marketing on behalf of defendants in my Table 3.

So I am looking at causation for non-defendants. I'm simply not attributing it to misconduct and therefore passing it on to Professor Cutler.

BY MR. ROTH:

Q. And with respect to the non-defendants, you're doing it on an aggregate basis as opposed to specific companies; is that correct?

A. My main analysis is on an aggregate basis, and then I do some sensitivity analysis where I remove individual defendants and then all the non-defendants' marketing on behalf of defendants.

Q. Do you know whether any of the non-defendant manufacturers utilize similar messaging in their promotional visits to the ones that the defendant manufacturers did that you described as the fraudulent scheme earlier?

A. I have not examined that question, no.

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Q. And if a court or jury were to find that those types of messages were unlawful for defendants, how would that affect how you calculate causation with respect to the non-defendants?

MR. SOBOL: Objection.

A. That seems to me to be a legal question. This matter has a specific set of defendants, and I am calculating impact for those defendants. I'm not sure if you're suggesting if I could include other manufacturers in those calculations? Absolutely. But that seems like it would be outside the scope of this matter.

BY MR. ROTH:

Q. And I think we talked about the illegal drug trade, but specifically, have you done any analysis as to causation with respect to pill mills?

MR. SOBOL: Objection.

A. No, I have not.

BY MR. ROTH:

Q. Or cartels or Internet sales of opioids?

A. No, I have not.

Q. You've done no analysis as to causation due to changes in reimbursement policies for prescription opioids?
MR. SOBOL: Objection.
A. I have not looked at changes in reimbursements specifically, no.
BY MR. ROTH:
Q. You've done no analysis as to causation as to changes in medical guidelines for the use of opioids?
A. Well, I do, as you know, in one model look at the effects of certain guideline-related events, so that happens in my Model C. But aside from that, I have not modeled other changes in guidelines, but to some extent there, yes.
Q. You've done no analysis of causation as to patients or users of prescription opioids?
MR. SOBOL: Objection.
A. I'm not really sure what you mean by that. My analysis is an industry-level analysis, so the patients of course are the ones filling the prescriptions that I'm counting and measuring.

So in the indirect analysis, I look at population characteristics as they are associated with shipments, cross-sectionally, so that is in some sense a patient-level analysis. I'm not entirely sure what you had in mind, however.
BY MR. ROTH:
Q. You don't attribute any causality to prescribing doctors?
MR. SOBOL: Objection.
A. Again, I am -- marketing is to doctors, and the doctors have to write the prescriptions, so they are in the causal chain of my analysis.
The mechanism is a detailing contact. If doctors did not respond to those details, then they -- my results would be quite different.
BY MR. ROTH:
Q. I understand they're in the causal chain. What I'm trying to understand is how your models assign a percentage of causality to prescribing doctors.
MR. SOBOL: Objection.
A. Again, from my point of view,

the question doesn't make a lot of sense to me because of the fact there is this causal chain, and what I've been asked to undertake is an analysis of the impact of the allegedly unlawful marketing.
It goes through doctors, so there -- the idea that there's a separate analysis of the effect of doctors on prescribing, they're already in my analysis. The question about parsing liability for those groups, I have not undertaken that because I'm not a lawyer, and I was not asked to offer an opinion on that.
BY MR. ROTH:
Q. And when you say the doctors are already in the analysis, they're in the analysis to the extent you're talking about detailing, but other factors that may influence the doctors' prescribing decision are not accounted for in your analysis, correct?
MR. SOBOL: Objection.
A. Well, again, I would say that's not entirely correct because these other factors that I capture in my model using

those eras, in addition in Model C, using the specific dummy variables, those operate through physicians.
And again, because these are prescribed products, the doctor has to write the prescription in every case, so even, you know, efforts, for example, to change the way state medical boards enforce prescribing around opioids, that's -- that's ultimately directed at doctors.
BY MR. ROTH:
Q. You agree that doctors act as a trusted intermediary when it comes to prescribing opioids?
MR. SOBOL: Objection.
A. As a matter of the way this market works, yes, that doctors are intended to be the agents of their patients.
BY MR. ROTH:
Q. You say in your report, paragraph 14: Physicians act as a trusted intermediary in prescription drug decision-making.
MR. SOBOL: Objection.
A. Yes.

BY MR. ROTH:
Q. And, in fact, you just said patients cannot lawfully obtain prescription opioids without a doctor's prescription.
MR. SOBOL: Objection.
A. Yes, that is correct.
BY MR. ROTH:
Q. So the doctor's an essential link in a patient legally obtaining prescription opioids.
A. Yes, physicians must write those prescriptions for them to be legal.
Q. And you agree that while patient preferences play a role in the choice of therapy, physicians have enormous influence over healthcare decisions?
MR. SOBOL: Objection.
A. Yes, I believe you just quoted me.
BY MR. ROTH:
Q. And to quote you again: Professional norms encourage physicians to use their clinical skills, knowledge and experience to make therapeutic choices that are in the best interest of their patients?

A. Just to be clear, I make those points because this is the reason why physicians are the target for this kind of misleading marketing, but it would not be enough, for example, to mislead patients through some direct-to-consumer advertising campaign.
This is why physicians are the target of this misinformation is because patients trust them.
Q. Okay. But clearly, marketing is not the only thing that controls a doctor's prescribing decision, correct?
A. Marketing -- I think it depends on how you describe marketing, and in my report, I give a sort of ecosystem around which physician behavior is affected and patient behavior. So we can think about marketing as details. That is clearly not the only thing that affects physician decision-making, but professional guidelines also do. What their peers say and do also does.
All of those things were affected by the alleged misconduct.

Q. Okay. So other than detailing visits, professional guidelines and what physicians' peers do, can you think of any other factors that influence a doctor's prescribing decisions when it comes to a product like prescription opioids?
A. Well, clearly doctors rely in part on the product label. I think there's some debate as to how much they rely on the product label, and if you've tried to read them, they're -- they tend to be very dense.
The beauty of marketing messages is that they are very simple, easy to follow.
Q. Okay. You understand that opioids have black box warnings on their product label?
A. Yes, I do understand that.
Q. And you understand that the FDA has issued a REMS program for certain opioids?
A. Yes, I understand that.
Q. And do you know what a REMS is?
A. The acronym, actually, I cannot say exactly what it is, but it is a condition

for prescribing. They differ by drug, so a well-known one is that females who want to be on Accutane, they all have to be on some kind of contraceptive. Products come with some conditions to ensure their safe use.
Q. Have you performed any study or analysis of the effect that a black box warning has on the prescription of a product with a black box warning like opioids?
MR. SOBOL: Objection.
A. I haven't specifically examined the effects of a black box warning. Again, in my description of the timeline of events here, I include those -- the black box warning, the REMS, for extended release and long-acting opioids as part of my timeline.
You know, as a matter of the way the -- both the marketing schemes and the public health responses unfolded in this matter, there were many changes, all around the same time, making it difficult to identify the effect of any one of them.
So I haven't done a regression specifically with the black box warning in it. If you look at the data, however,

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there's no sharp fall-off when the black box warning comes up.
BY MR. ROTH:
Q. Are you aware of any literature that reviews how a black box warning affects the impact of marketing for the product with a black box warning on prescribing physicians?
A. I'm aware that such literature exists, and I've certainly looked in detail at that matter in the case of other products such as antipsychotics, where marketing essentially was designed to counteract the black box warning, so I think that's commonly a strategy by manufacturers is to try to soften the effects of the black box warning.
And in published literature, there's a mixed view about how effective black box warnings are in changing behavior.
Q. And can you think of any study as you sit here today that says that even in the face of a black box warning, physicians will prescribe the products in a way that is antithetical to the black box warning?
MR. SOBOL: Objection.

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A. I can't think of a specific paper. I can recall a specific analysis that I did looking at antipsychotics when the black box warning went into effect that basically said there's a substantial increase in mortality for the elderly for -- using antipsychotics, which was generally done as a method of chemical control for patients in long-term care in particular. And physicians, while there was an initial drop in prescribing it, very quickly went back to existing levels despite the fact that there were these very severe consequences.
BY MR. ROTH:
Q. But you haven't performed that analysis for any prescription opioid product at issue in this case?
A. I have not.
Q. So you don't know how the black box warning or the REMS impacted the effectiveness of defendants' marketing on opioids?
MR. SOBOL: Objection.
Objection.
A. Again, I attempt to capture

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some of those factors in the nature of my model, which we will no doubt talk about, and, in fact, the effectiveness of marketing begins to decline around the period that these policies went into effect.
And so I do capture that by allowing the environment to change the effectiveness of the marketing.
BY MR. ROTH:
Q. Have you performed or reviewed any study or analysis of the information available to doctors regarding opioids over time?
A. I have reviewed some materials that you can see in my report at a high level in terms of, for example, what -- what the CDC was saying in their guidelines. That's a channel for information, and certainly the REMS, the fact of those coming out.
I have not systematically looked at the broader information. I rely in part on other experts to describe that. Again, Dr. Perri's report does quite a bit of that.
Q. You understand that opioids

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have been used for the treatment of pain for centuries?
MR. SOBOL: Objection.
A. I do understand that opioids, yes, opium and morphine in particular, yes, have been used for many, many decades.
BY MR. ROTH:
Q. And the addictive property of opiates, whether they be opium or opioids, has also been long known.
Would you agree with that?
A. Yes. Again, I wouldn't rely on my own expertise for that, but I understand that, certainly, from reading the clinical experts' reports, and as a general matter I believe it's long been known that opium and morphine were addictive, in the Civil War and before that.
Q. You say in paragraph 15 of your report that both physicians and patients -- let me know when you're there. Got it?
A. Yes.
Q. Both physicians and patients face an information problem in selecting pharmaceutical treatments that challenges

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typical conclusions about well-functioning markets.

Do you see that?

A. Yes.

Q. And that paragraph goes on to talk about how these are experienced goods, and further down: For example, and in the present matter, the stigma associated with opioid addiction likely compounded the information problems.

And then the last sentence: In light of these information problems, it would be reasonable to expect that market forces alone would fail to protect consumers against false claims of product efficacy and safety.

Do you see that?

A. Yes, I do.

Q. I notice you don't call out addictiveness separately. I mean, do you think that there's insufficient market information for doctors or the general public to know about the addictiveness of prescription opioids?

A. I intended to include addiction, which is clearly the biggest risk

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of opioids, when I was talking about risks and side effects. It's a more general statement here, but that was my intention.

And, yes, as I -- as I understand the facts here, while doctors understood that opiates and opioids had addictive properties, that because of the defendants' misconduct, there was essentially a shift in the belief about the relative trade-offs between addiction risk and pain control, and that again, the addiction risks were downplayed substantially, despite prior knowledge that these newer products were somehow different and would somehow not deliver the same addiction risk.

Q. Okay. But at a certain point in time market information can become robust enough that the players in the market understand the true nature of what they're dealing with.

Do you agree with that as a general proposition?

MR. SOBOL: Objection.

A. No, I would not agree with that as a general proposition.

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BY MR. ROTH:

Q. So you think the market just never has enough information for people to make informed decisions?

A. I'm an empirical economist, and like you, I was aware that opiates had been around for a long time, and yet, in the middle 1990s, we see this dramatic increase in opioid prescribing. To what -- that is clear evidence that something dramatic shifted, and I understand that if the allegations are proven, that something is marketing.

I don't think that there's any truth in the world that could not be reversed by good marketing.

Q. So your view is even today, with the publicity that the opioid issues have gotten and the CDC guidelines, there still are people with incomplete information that are continuing to be fooled by marketing?

MR. SOBOL: Objection.

A. I would say that that is very likely, that there are still people who

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continue to believe that opioid treatment is a relatively safe prescribing opportunity, and certainly, while we've seen a fairly substantial decline in prescribing, it has not yet gone back to 1995 levels.

BY MR. ROTH:

Q. And you would attribute some of the substantial decline in prescribing to market information coming to light, would you not?

A. I would attribute it to public health interventions, some of which are informational, some of which are more restrictive, just simply putting limits on prescribing.

So it's a combination of informational and command and control efforts on the public health side.

Q. Okay. I think we talked about this, but I'm going to ask again because I'm not sure.

You would agree that doctors are motivated by many factors beyond just marketing?

MR. SOBOL: Objection.

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A. I guess I'm not sure the context for that statement, so I -- I would agree that physicians do not rely solely on marketing for decision-making. You said motivated, and I guess I don't know what you mean by that.
BY MR. ROTH:
Q. I'll take your answer.
Physicians do not rely solely on marketing when making a prescribing decision?
A. Yes, I think that's true, and still, marketing has a really important effect on their behavior.
Q. Physicians rely on clinical results and scientific publications to make prescribing decisions?
MR. SOBOL: Objection.
A. In some cases, they may do so, and as I note in my report, relying on clinical results when there's not a clear feedback loop, there's not a -- there's not a blood test for pain, so, you know, when I put you on Lipitor, I can check your cholesterol and know whether it's working or not.

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But when I put you on an opioid, I have to take you at your word about what you're feeling and reporting to me.
So I think relying on results is a very tenuous notion in this case.
BY MR. ROTH:
Q. Is that true for antidepressants as well?
A. It may well be true for antidepressants as well.
Q. So in your world, are there certain drugs that we just never know the efficacy of because they're essentially subjective in whether or not they're taking effect?
MR. SOBOL: Objection.
A. I don't yet have my own world. I'm working on that. But in the actual world, there are certain properties of drugs, of certain drugs, that -- where it's really hard to ascertain their effectiveness, and so that's one of the reasons, of course, we rely on randomized control trials that have -- try to clear out a lot of dust and capture information in a systematic way, and purely

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observing patients over time is a very difficult way to ascertain whether an antidepressant is working, whether an opioid is working, and how.
As I noted earlier in our discussion that my understanding of one of the allegations is that defendants encouraged doctors to ignore what would have been signs of addiction by just saying, no, no, that's just the patient adjusting. Of course, you need to titrate up the dose.
So I think it's a very complicated situation for physicians or patients to really ascertain what's happening in terms of effectiveness.
BY MR. ROTH:
Q. You understand, though, that for opioids, the FDA requires randomized clinical trials on efficacy before they approve use of those drugs?
A. Yes, I do understand that. Those randomized control trials do not cover every use that physicians ultimately prescribed opioids for, and I think that's part of what the concern here, is the -- what

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we might in health policy call indication creep.
So also, those randomized control trials are very short term. They're always short term by definition because of the cost of undertaking those trials.
Q. Okay. None of your models account for the impact of published clinical results for opioids on prescribing doctors, correct?
MR. SOBOL: Objection.
A. My models do not explicitly account for publications, no.
BY MR. ROTH:
Q. Do you agree that prescribing habits may be confounded by other unobserved doctor-specific characteristics?
A. In a time series analysis, such confounding would only be of concern if the trend in those characteristics was in some way negatively or positively correlated with marketing. I can't think of anything that would fit that category.
Q. I'm not talking about your regressions. I'm just asking a more global

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question, which is: An individual doctor's prescribing habits can be confounded by other unobserved characteristics?

MR. SOBOL: Objection.

A. I don't know what you mean by confounded. When you say confounded, I am assuming -- and please correct me if I'm wrong -- that you're asking that in a sort of statistical sense.

BY MR. ROTH:

Q. Yeah. Okay. So, I am.

(Whereupon, Deposition Exhibit Rosenthal-5, 2016 Datta and Dave Publication, was marked for identification.)

BY MR. ROTH:

Q. Let me mark as Exhibit 5 is Datta and Dave study --

A. I keep thinking it's "Dah-vay."

Q. You know, I did too. Well, however you pronounce the gentleman's name, I apologize, Effects of Physician-directed Pharmaceutical Promotion on Prescription Behaviors: Longitudinal Evidence.

Do you have that in front of

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you?

A. I do.

Q. And this is a study you rely on and cite in your report?

A. That's correct.

Q. And this study actually looked at longitudinal evidence and developed a regression to determine the effect of marketing and other behaviors?

A. Yes. But just to be clear, when they say longitudinal, they're not wrong, but they're talking about two years of data. This is -- this is a bit different than the aggregate time series that I used. So just to be clear, they have multiple observations per physician over a two-year period.

Q. Okay. If you turn to page 456, and at the bottom of the page -- or sorry, let me get myself to the right place. Sorry, it's -- yeah, it's 456, bottom of the page.

A. Okay.

Q. The very last sentence, it says: Furthermore, the link between DTPP and prescribing habits may be confounded by other

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unobserved physician-specific characteristics such as inertia in prescribing patterns, brand loyalty, patient mix, tolerance for risks and preferences toward trade-offs between efficacy, contraindications and long-term use for prophylactic purposes.

Do you see that?

A. Yes. And again, those are all cross-sectional concerns, so when one is doing an analysis, as they do, that incorporates both cross-sectional and time series variation, so they have a panel of physicians that they're looking at their prescribing for a particular herpes drug and its competitors.

And when you're looking cross-sectionally like that at physician-level data, you would need to account for those physician characteristics when you're looking at aggregate data over time that you would not need to look for those characteristics.

Q. And you look at aggregate data?

A. That's correct.

Q. Did you try to look at

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physician-specific cross-sectional data?

MR. SOBOL: Objection.

A. Unlike Datta and Dave, I do not have promotional data at the individual physician level. As you no doubt noted in their literature review, it's fairly uncommon to be able to get data that have physician-level detailing, which is what they use, as well as prescribing habits. So there are a few marketing scholars who essentially have had good relationships with companies and have been able to get those kinds of data. I don't have access to those data.

BY MR. ROTH:

Q. Well, you understand that all these companies are defendants in the case and have produced documents as part of the lawsuit, correct?

MR. SOBOL: Objection.

A. I understand that these companies have produced documents as part of the lawsuit. They have not produced data with detailing information by physician that can be identified and linked to prescribing.

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BY MR. ROTH:
Q. And --
A. I did look for those data.
Q. You did look for it. And that's true of every single manufacturer defendant, there is no physician-level detailing data available?
MR. SOBOL: Objection.
A. There were no physician-level detailing data for any manufacturer that covered the period of interest. So in order for me to do my analysis, I would need those data for all the defendants for the entire time period.
So where -- to the extent that we found any data, they were bits and pieces of contact registries, essentially sales databases, which are not the same level as what these folks have -- they have actual linked data, linkable.
BY MR. ROTH:
Q. But you didn't take the specific data you had for individual defendants for whatever time period you had to test the results of your regression

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against a model you could do on just that data?
MR. SOBOL: Objection, form and asked and answered.
A. There would be no such test. These -- the goal of my analysis and the goal of Datta and Dave's analysis are completely different. So there -- there would be no point in comparing those results.
They are trying to ascertain the extent to which detailing across physicians drives marketing impact, so they're really interested in questions like, you know, what -- how -- how much does it make sense for a company to detail high prescribers versus low prescribers to a greater degree.
I'm interested in the aggregate impact, and so that is what my model does best. Their model would not be appropriate for ascertaining the aggregate impact.
BY MR. ROTH:
Q. I understand you're interested in the aggregate impact, but if one were interested in the individual impact of any

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single manufacturer's detailing, you could run an analysis similar to Datta and Dave using whatever data were available for that manufacturer?
MR. SOBOL: Objection.
A. There are two levels of aggregation here. One is from the doctors up to the total product level, and the other is from the product to the defendant to the whole class, if I can use that term to describe all the opioids that we're interested in here.
So Datta and Dave are at the most granular level, the individual doctor prescribing for an individual drug.
I am interested in understanding how marketing as a whole drove sales in this market and I want to capture all of the spillover effects. They're trying to tease out other kinds of effects.
This analysis could not be used to get an answer to the question what would have happened if these manufacturers had not marketed their products.
///

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BY MR. ROTH:
Q. And the reason you're interested in the aggregate question is that was the charge you were given by plaintiffs' counsel was to look at the aggregate impact as opposed to an individual defendant-specific impact?
A. Well, again, there are multiple levels of aggregation here, so if I -- my model, as you know, can be used to parse out individual defendants as I have done in Table 3 of my report, so it can look at an individual defendant, and I've shown you results excluding individual defendants. So it is already doing that.
It's the cross-sectional nature of what they're modeling here with the physician-fixed effects. They're really trying to tease apart how manufacturers go about targeting doctors for marketing and what effect that has.
I'm not interested in that effect, and so it wouldn't be appropriate even if I were only looking for one defendant.

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Q. So you're not interested in trying to ascertain how manufacturers' targeting for marketing has an effect.
What is the question you're seeking to answer?
MR. SOBOL: Objection.
A. The question that I'm seeking to answer is what is the effect of marketing by defendants for opioid products on their sales, and if that effect --
BY MR. ROTH:
Q. I'm sorry to stop you. At an aggregate level, I assume you mean?
A. At an aggregate level. Again, my model can look -- pull out the effect for individual defendants, but at an aggregate level.
And so all I'm saying is that if that effect comes because one manufacturer targets just the high prescribers and is very effective there and another manufacturer details everybody, that is not relevant to what I have been asked to undertake in this case, and so I don't go into the level of -- the physician level the way Datta and Dave do

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because it's -- it's not relevant to my conclusions.
Q. Have you tried, for any of the individual manufacturers for which you have specific data, to pressure test your conclusions in Table 3, from removing them from the aggregate data to see if those hold?
MR. SOBOL: Objection, form.
A. Can you repeat? Because I just want to make sure I understand the question you're asking.
BY MR. ROTH:
Q. Yeah. So as I understand your model -- and again, we will get into the details, I promise -- but you essentially back out from the aggregate model individual defendants, and you present those in Table 3.
MR. SOBOL: Objection.
A. That's correct.
BY MR. ROTH:
Q. So my question is: Have you run a Datta and Dave type of analysis for any of the individual manufacturers listed in Table 3 to compare how the aggregate results in Table 3 hold compared against the Datta

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and Dave type analysis we've been discussing?
MR. SOBOL: Objection, asked and answered.
A. I think, again, you misunderstand what the utility of the Datta and Dave analysis is. It is an analysis that is designed to dig into how marketing works and not whether.
There would be no utility in comparing results of a Datta and Dave analysis, if one were possible, with my aggregate results because the questions they're looking at are entirely different.
BY MR. ROTH:
Q. And why is the question you answer only about how marketing works as opposed to whether?
A. No. Sorry. Their how.
Q. Okay. Why is -- So how are you answering the question through your aggregate model whether marketing works if you're not looking at it on an individualized doctor-specific level?
MR. SOBOL: Objection.
A. My analysis is a model of the

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effect of detailing as a whole for this class, its effect on sales in the form of milligrams of morphine equivalent, just to be clear.
So my right-hand side variable is detailing. My left-hand side variable is MMEs. Datta and Dave -- so that tells me, if marketing increases in this area as a whole, what happens to MMEs? That's the question that relates to my assignment.
Datta and Dave are asking, you know, can we examine and tease out to what extent manufacturers target specific types of physicians and whether the prescribing of physicians is more driven by this targeting question or by the marketing effectiveness.
They're doing so on a very short time period in the scheme of things, right? So two years of data doesn't -- doesn't allow them to look, for example, at what happened before that two-year time period in terms of the buildup of knowledge about these products, all of those things that are captured in the stock of detailing that I use.

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And so they have this interesting work that tells us something about responsiveness of physicians, but it doesn't get us to the aggregate question about how -- to what extent does marketing across all of their drugs affect the size of the market.

BY MR. ROTH:

Q. What have you done to answer the individualized question of whether targeting certain physicians by the manufacturers in this case was the cause of additional MMEs as opposed to the effectiveness of the marketing overall?

MR. SOBOL: Objection.

A. That question is not relevant to my charge. I want to understand what is the total effect. I have -- I do not know why the court would want to understand what aspects of the targeting of specific physicians that drive marketing increases.

BY MR. ROTH:

Q. What have you done to answer the individualized question of whether certain messaging by individual manufacturers

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led to an increase in MMEs?

MR. SOBOL: Objection.

A. As we have discussed, I am taking an assumption from counsel, as experts always do, that they will prove their case, and specifically, the relevant assumption I have made is that all or virtually all marketing by defendants from 1995 to the end of my data was unlawful.

I have reviewed documents and other expert reports. I have not parsed out individual messages and in any way parsed out the marketing that I assume to be unlawful in my model to differentiate from one to another.

BY MR. ROTH:

Q. Do you agree that standards of care influence prescribing decisions?

A. What -- do you mean by standards of care something very general or do you mean that in the sort of the negligence sense, since you're a lawyer?

Q. That's fair. You've done this a lot because you went somewhere that I wasn't going.

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I meant the more general. Do you agree that sort of the prescribing and treatment standards of care can influence prescribing decisions?

A. Again, I would say if we looked at my ecosystem, I don't know that I call out standards of care specifically, but if those, for example, are set in part by what your peers are doing, if those are set in part by professional guidelines, then, yes, I believe that those are relevant determinants of physician behavior.

And as I said earlier, I also believe that those would be affected by the alleged misconduct.

Q. Although detailing is not the same as affecting the standards of care, right? Those are two different marketing channels?

A. It's not clear to me that detailing would not affect the standards of care. Detailing could, for example, try to convince individual physicians that it's okay to prescribe opioids more broadly by citing guidelines, by citing peers and key opinion

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leaders. So I think it could well be wrapped up. I don't know why they'd be independent.

Q. Do you agree that patient preference can affect a physician's prescribing decision?

A. Yes, of course patient preference can affect a physician's prescribing decision.

Q. Loyalty to certain drugs can affect a physician's prescribing decision?

A. Physicians -- it has been found in the literature that physicians have a tendency to prescribe a particular drug once they've gotten used to it, so in the antidepressant class, for example, that's been shown.

Q. Drug reimbursement policy can affect physician's prescribing decisions?

MR. SOBOL: Objection.

A. Yes, all of these factors, the last two factors, I would say they're most likely to affect physician prescribing patterns by the specific brand or brand -- in the case of reimbursement, brand versus generic as opposed to whether the physician

Page 90

prescribes an opioid.
BY MR. ROTH:
Q. And we'll get to this later, but to the extent you're looking at detailing visits, you don't differentiate between detailing visits that are just driving at rivalrous marketing to get a prescriber to switch opioids versus detailing visits that are trying to get doctors to prescribe opioids as a class of therapy?
A. I don't differentiate on the right-hand side, and so if, in fact, detailing was all rivalrous, my results would show that marketing doesn't affect sales. So that is the point of the analysis, is to ascertain.
So you could imagine doing an analysis in a market that has a fixed size, where all marketing is rivalrous, and there's some discussion for other drugs where marketing appears to be more about market share and not about driving the size of the market as a whole.
But, in fact, my analysis shows that the market expansion effects were

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important, whether or not there was also rivalry.
Q. You agree, though, that if a manufacturer was only engaged in rivalrous marketing, for example, that would be qualitatively different than trying to make the market and convince prescribers to move patients on to opioids?
A. I don't believe in the conceptual premise that you have just put forth that there's such a thing as purely rivalrous marketing, in the case where the market is not fixed by some reason.
So even if, you know, I go and I market for Coke and it's not that I'm trying to get you to drink more sugar-sweetened beverages, I just want you to stop drinking Pepsi, that will still remind some people that, oh, yeah, I should think about having a Coke this afternoon instead of my usual coffee.
So I think there will be market-increasing spillovers even from purely rivalrous marketing.
Q. The economic literature doesn't

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agree with you on that, though?
A. I'm not sure that that's true.
Q. We'll look at it.
A doctor's own medical judgment can affect prescribing decisions?
A. I think it would be very difficult to say that that was not true.
Q. And in fact, I think Professor Cutler has got a working paper where he draws that conclusion. Have you studied that or read that paper?
A. You'd have to put it in front of me.
Q. We can look at it quickly.
(Whereupon, Deposition Exhibit Rosenthal-6, 2015 Cutler et al Working Paper, was marked for identification.)
BY MR. ROTH:
Q. So I'll mark as Exhibit 6 Physician Beliefs and Patient Preferences: A New Look at Regional Variation in Health Care Spending.
And if you look at page 5, do you see in the middle of the page there's a paragraph that starts with "Ultimately"?

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A. Uh-huh.
Q. He says --
MR. SOBOL: Wait, is this an excerpt or is this the whole article?
THE WITNESS: It's an excerpt.
MR. ROTH: It's an excerpt. It's an excerpt.
A. I just want to just review the front piece so I can --
BY MR. ROTH:
Q. Sure.
A. -- understand what it's about.
(Document review.)
A. Okay.
BY MR. ROTH:
Q. So in the paragraph I was pointing you to, it says: Ultimately, the largest degree of residual variation appears to be explained by differences in physician beliefs about the efficacy of particular therapies. Physicians in our data have starkly different views about how to treat the same patients. These views are not strongly correlated with demographics, financial incentives, background or practice

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characteristics and are often inconsistent with evidence-based professional guidelines for appropriate care.
Do you see that?
A. Yes, I do.
Q. And do you have any reason to believe that is not true of physicians when they prescribe opioids?
MR. SOBOL: Objection.
A. Well, just to be clear, the context that they're looking at is not one that's subject to marketing, but in any case, there's no presumption here that those beliefs are not set by some other factors, right.
So they're -- they're -- they're trying to identify all the forces that they can measure, including financial incentives and other characteristics, and so they're putting in beliefs everything else.
But that's not to say that those beliefs couldn't be shaped by marketing. So I think it would be a mistake to consider beliefs as independent. I wouldn't say that they're a hundred percent

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set by marketing, but they're clearly influenced by marketing. That's really the issue at hand here.
BY MR. ROTH:
Q. Are there physicians in the world who don't allow detailing in their offices?
MR. SOBOL: Objection.
A. Yes. But again, I think conceptually, that's the wrong way to look at this, as I have noted in my report, that even if you never have someone detail you, you're -- you're connected with peers, you are getting messages through professional societies.
It would be hard to imagine a physician who's completely untouched by the alleged misconduct in this matter.
BY MR. ROTH:
Q. Do you agree that characteristics of individual patients can obviously affect prescribing decisions?
A. Yes. I would hope that physician characteristics matter to -- sorry, patient characteristics matter to physicians

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when they're prescribing.
Q. And then you also mentioned this earlier, but risk aversion or potential medical malpractice liability could also influence prescribing decisions?
A. That is possible. That is possible, and I believe that is part of what the model guidelines for state medical boards is intended to address.
Q. Okay. And just so I understand your position on this, do you believe there are aspects of a doctor's prescribing decision that are unaffected by marketing, or is it your view that marketing infiltrates everything in their mind at the time they decide to prescribe a product like a prescription opioid?
MR. SOBOL: Objection.
A. I don't know exactly what you mean by that, but I can tell you what I believe. I believe that modern pharmaceutical marketing, including the tactics that are described in the complaint in this matter, is comprehensive and ubiquitous.

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Does that mean it is strictly determinative of what every physician does for every patient? No, I do not believe that. I do believe that marketing, it can't be teased out in terms of looking just at what physicians were detailed, but it has an influence that is quite broad.
Other factors will certainly be important, but the question here is really what is the incremental effect of marketing on the prescriptions that physicians write.
BY MR. ROTH:
Q. Have you reviewed the facts of any prescription by a doctor of an opioid in this case?
A. I don't think so, no.
Q. And you don't know how, on an individual level, a specific doctor was affected by a detailing visit in your model because you haven't done that analysis?
A. I have not looked at individual physician-level data as we discussed, and I do not believe it is the most appropriate path to fulfilling my assignment.
Q. Okay. And your model does not

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attribute any percentage of causality to prescribing doctors for the increased volume of MMEs that you calculate?

MR. SOBOL: Objection, asked and answered.

A. As we've discussed earlier, that notion, just conceptually, I struggle with the idea that you're asking me to consider. Every prescription in my data was written by a physician.

BY MR. ROTH:

Q. Right. But I asked a little bit of a different question.

You don't have a percentage line in your report for doctors the way you do in Table 3?

MR. SOBOL: Objection, asked and answered.

A. Well, again, just that would make no sense to me, so the marketing in question operates through doctors.

MR. ROTH: Why don't we take a five-minute break.

MR. SOBOL: Okay.

THE VIDEOGRAPHER: The time is

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9:31 a.m. We're now off the record.

(Recess taken, 9:31 a.m. to 9:46 a.m.)

THE VIDEOGRAPHER: The time is 9:46 a.m. We're back on the record.

BY MR. ROTH:

Q. Professor Rosenthal, if you could turn to page 13 of your report, paragraph 16, and tell me when you're there.

A. Yes.

Q. You've got a heading, The Role of Public and Private Health Insurance.

Do you see that?

A. Yes.

Q. And you say in paragraph 16: Another distinguishing feature of pharmaceutical demand is the widespread presence of insurance coverage. As of 2017, approximately 88% of nonelderly adults have insurance coverage through a private or public health insurance plan.

Do you see that?

A. I do.

Q. And then you go on to talk about the Affordable Care Act and then you

Page 100

say: Insurance coverage among the elderly is virtually universal, and among those enrolled in Medicare, the vast majority have prescription drug coverage either through Medicare Part D or retiree plan.

Do you see that?

A. Yes.

Q. We talked about this a little bit earlier, but are you aware of pharmacy benefit managers?

A. Yes, I am.

Q. What are they?

A. Pharmacy benefit managers are essentially specialty health insurers. They manage only the pharmaceutical part of the health benefit, and they typically contract either with a primary health insurer or a self-insured employer.

Q. And what role do they play in providing insurance coverage or approving prescriptions of opioids?

A. Pharmacy benefit managers, they have pharmacy networks, so they negotiate contracts with pharmacies. They adjudicate claims electronically. They typically define

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formularies, so which drugs are covered, and they offer employers and health plans alternative copayment structures. So those are their main roles.

Q. And you just mentioned formularies. How would you define what a formulary is?

A. A formulary is a list of covered drugs. An open formulary means that the list is preferred drugs, but other drugs are still eligible for reimbursement. A closed formulary is a list of drugs that are exclusively covered by a health plan.

Q. Given the pervasiveness of insurance and the role that PBMs and formularies play, what analysis did you perform on the role of insurers in assessing the volume of MMEs in your models?

A. Well, if I understand you correctly, I think we have a very similar situation conceptually to the one we talked about earlier with physicians, not a hundred percent the same.

But PBMs and health insurers adjudicate and pay for claims associated with

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opioid prescriptions. There is a small percentage of consumers that pays for their own prescription drugs. It varies from drug class to drug class, but perhaps 5 or 10% of individuals pay out of pocket, and therefore PBMs and health insurers have no role, but in the context of insured patients, the insurer is on the causal chain between the sales data we see and the marketing I measure.

Q. And did you do any analysis as to how the insurer influences the MMEs ultimately prescribed through their role in the causal chain?

MR. SOBOL: Objection, asked and answered.

A. Like many of the individual factors we talked about when it comes to patient characteristics and physician characteristics, characteristics of the health insurance coverage are included in my analysis implicitly but not explicitly.

Because my analysis is concerned with looking at these aggregate trends, there's not an appropriate place to look at the variation in health benefits, as

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I believe I think you're asking.

BY MR. ROTH:

Q. Did you study how insurance coverage for prescription opioids compares to substitutes or alternatives for the conditions prescription opioids are prescribed for?

MR. SOBOL: Objection.

MR. ROTH: Let me rephrase the question because that came out muddled.

BY MR. ROTH:

Q. Did you study how insurance coverage for prescription opioids compares to insurance coverage for their substitutes?

MR. SOBOL: Objection.

A. I did not study individual benefit designs for opioids, and I am not a hundred percent sure I know where you're going with that question, but if you're asking about physical therapy, for example, I did not look at coverage.

Again, in the context of my analysis, if, for example, there were differences in coverage for opioids versus

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physical therapy, that would affect the level of sales. It would not be correlated with and therefore confound the effect of marketing.

BY MR. ROTH:

Q. Okay. Talking about physical therapy, nonsteroidal antiinflammatory drugs, other things that could be used to treat the same things as opioids, so we're on the same page.

A. Okay. When you say "things," do you mean pain?

Q. Pain -- primarily, yeah, pain, I would say.

MR. SOBOL: Why don't we start again.

MR. ROTH: Okay.

BY MR. ROTH:

Q. I'm talking about substitutes that could be used to treat pain other than prescription opioids, including your example of physical therapy, nonsteroidal antiinflammatory drugs and other such therapies, okay?

A. Okay.

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Q. And just so we have a clean transcript, you have not studied how insurance coverage for prescription opioids compares to insurance coverage for substitute therapies for the treatment of pain?

A. I have not studied that because it is not appropriately captured in the analysis that I do, no.

Q. Do you agree that insurers will sometimes create formularies to pursue less costly therapies?

A. Yes, I would say the formularies are typically designed to balance affordability and accessibility of effective treatment. So costs are one of the considerations in creating a formulary.

Q. And to the extent formularies prefer prescription opioids because they cost less than other therapies, that might drive consumption of prescription opioids?

MR. SOBOL: Objection.

A. I'm just -- I just want to understand, make sure I understand the question.

If formularies had more

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generous coverage for opioids than some alternative pain therapy, that that might again -- it might affect the level of sales of opioids relative to other pain therapies.

It would not -- that difference would not be correlated with the intensity of marketing in a given period, and therefore, it would not be confused with the effect of marketing.

So I think it's really important that we get very clear that there are factors, such as patient characteristics, such as these formulary differences that will affect in a cross-sectional way the difference between whether I get opioids and whether you get opioids, the use of opioids.

But that does not mean that they will affect opioid sales over time or, more specifically, in a way that's correlated with marketing, and therefore, would confound my estimates.

BY MR. ROTH:

Q. How do you know that those issues would not affect opioid sales over time or be correlated with marketing?

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A. Well, a couple of things. One, we do know from the research of others that insurance expansion does not appear to have caused increased opioid prescribing, so that, as a high-level matter, suggests that these factors are not important.

The -- we also know from looking at detailing that, you know, clearly, aggregate detailing in this market has been substantial over these particular time periods, leading to a stock of detailing that I'm sure we'll look at, but is visually depicted in my report.

The cross-sectional variation in the generosity of coverage for particular drugs is a phenomenon that just could not be correlated with those marketing increases over time.

Q. You say it's a phenomenon that could not be correlated, but you did not include variation in the generosity of coverage as an independent variable in either of your models, correct?

A. It is not included in my model, no, and again, I do not believe it's

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appropriate to include in there.

Q. So you didn't test it as a variable to confirm your presumption based on your model's output that it wasn't correlated?

MR. SOBOL: Objection, form, asked and answered.

A. You've created this hypothetical about differences in formulary coverage. When you say you didn't test it as a variable, I don't think that's a variable exactly. I'm not sure how one would measure the relative coverage generosity, so I have not looked at that, no.

BY MR. ROTH:

Q. You said there's literature saying that insurance expansion did not cause increased opioid prescriptions. What are you thinking of?

A. There's a paper by Brendan Saloner. I believe it's cited in my report, but I'm just going to look at my Documents Relied on. It does not appear to be there.

Q. So it's something you reviewed outside of the context of this case that is

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not on your Attachment B or cited in your report?

A. Yes. I didn't rely on it in my analysis, but I -- it's a paper that I've reviewed. Brendan Saloner happens to be a student of ours from Harvard and, in general, I try to keep up with the literature in areas that I'm interested in.

Q. Because it wasn't disclosed in your report, I haven't seen it yet, but I'll look at it between now and the end of your deposition and we can talk about it.

A. Yes.

Q. If you look at --

MR. SOBOL: Do you have a spelling on the last name then?

A. S-A-L-O-N-E-R.

BY MR. ROTH:

Q. And do you know what kind of study it was or the title or the date? Any identifying information would be helpful.

A. It would have been in the last couple of years, and, yes, I don't -- I think it would have had the Affordable Care Act in its name.

Q. Okay. But you do agree that if there is insurance coverage for opioids, that could lead to more utilization of opioids?

A. I guess I believe that insurance coverage at some level has an effect on sales, and -- and that -- that effect is captured in the aggregate sales data.

So to the extent that coverage for some people was less generous, sales are lower, so that's captured in the data. And like other factors, my model uses, for example, changes in prices. It uses the specific eras that I have delineated that show the environment in which marketing was generating sales changed. Health insurance might be part of that change.

And so I believe that this fact is appropriately captured in my model. The cross-sectional variation that you're talking about, differences among people, that does not belong in an aggregate time series model.

Q. Do you agree that there is price sensitivity with respect to the prescription and consumption of prescription

opioids?

MR. SOBOL: Objection.

A. Well, I think there are two parts to what you just asked, and I'm a health economist, so I won't say I don't believe in price sensitivity.

As you may know, healthcare is less sensitive to prices than other goods, and I describe the reasons why that is true in my report. But consumers do respond to the out-of-pocket cost, and that may again mean that people are more likely to use a generic if one is available. It may affect the level -- the extent to which people fill prescriptions at all. So there may be an effect on aggregate sales.

I would expect on the patient side it would have an effect on which opioid they would use more likely than whether.

On the physician side, which I thought was implicit in the way you framed the question, it's not at all clear that physicians are price sensitive. They frequently lack information on things like benefit design, and I address that in my

report, is that one of the challenges in this market is that physicians are making the decisions and they are neither financially responsible for nor them generally aware about prices.

BY MR. ROTH:

Q. No, that's helpful.

If you look at paragraph 17, the reason I asked the question is you say: The lack of price sensitivity on the part of physicians and patients due to insurance has had two important consequences.

If I understand your testimony, really, we should focus on the physicians more than the patients. Patients may, in fact, be price sensitive.

A. So when I'm using the term there -- and thank you for pointing me to that -- I'm really talking about the total price of the drug. And so generally, because patients have insurance, they see a small copayment, and so those copayment -- they may be sensitive to those copayments, which are the relevant price at the pharmacy for an insured consumer, but they're not sensitive

to the total price of the drugs.

Q. Well, they're sensitive to whether it's covered by insurance or not in the first instance, though.

A. Yes. I mean, I would think about that as a continuous thing, right. Coverage is a function of whether, but also the generosity of coverage.

Q. Yeah. Just to give you a concrete example, so Mrs. Smith goes to the doctor for back pain and he says you could do occupational therapy with Dr. Jones down the street for six months and try that out, or I can write you a prescription for hydrocodone. One is covered, one is not. She's going to prefer the covered choice, I would think, as a consumer.

A. Well, that's not how I would approach that question as an economist, but, you know, I would say that the out-of-pocket cost of those alternatives is one factor, and there are other kinds of costs and benefits.

Q. All things being equal, if she's solely driven by the price tag, she's going to prefer the covered therapy as

opposed to the uncovered therapy, recognizing as you did that there may be other reasons why she might have a preference?

A. Such as addiction risk and the like. I think the out-of-pocket cost will be relevant to that decision.

Q. I promise we're almost to your models. Just one more general area first.

Your direct model is based on national data with respect to detailing, correct?

A. Yes, it is.

Q. And nationwide data with respect to MMEs dispensed as well?

A. Yes, it is.

Q. Your indirect model is based on the ARCOS data, which you describe as county level, and we can talk about that later; is that right?

A. Yes.

Q. Okay. That was a terrible question.

So your indirect model is based on the ARCOS data, which is then subdivided into county-level data.

A. It is. I guess when you say subdivided, I think it comes that way, but yes, right.

Q. And your indirect model does not have a detailing variable because you're essentially solving for marketing by including other variables in that approach?

A. Yes. The purpose of the indirect model is to go another way around and ignore the detailing data.

Q. If you take out -- put another way, if you take out everything else that would be relevant, what is left is detailing in the indirect model?

A. Yes.

Q. Okay. So the only model with detailing data is the direct model, and for that you use national data?

A. That's correct.

Q. So you don't have any model that measures the effect of detailing within either Summit or Cuyahoga County?

MR. SOBOL: Objection.

A. My model looks at detailing as a national phenomenon, which as I note in my

report, detailing is generally a national phenomenon.

And I take the relationship between detailing and sales, and I apply it to Summit and Cuyahoga, or it ultimately gets applied downstream rather, but I do not have detailing at a level other than national and so cannot run a model at a lower level of geography.

It's my belief that these patterns are the same across the country, and I believe there's some testimony to that effect.

BY MR. ROTH:

Q. So you did not model marketing within either Summit or Cuyahoga County against MMEs within Summit or Cuyahoga County?

A. As we've discussed, my model looks at these relationships at a national level because that is really the level at which manufacturers set their strategy and the appropriate level to look at the effectiveness of marketing.

Q. Do you know how many of the

detailing visits in your data occurred in Summit County or Cuyahoga County?

A. In the IMS -- or, rather, excuse me, the IQVIA data specifically, there is not a method for apportioning those from county to county.

Q. Did you do any analysis as to whether the impact of defendants' marketing varied by county, or was it not done because you assumed it was national in scope?

MR. SOBOL: Objection.

A. I believe that is appropriate to assume that the effectiveness, the relationship between marketing and sales is the same across counties, and -- and again, my data do not allow me to parse out detailing at a county level.

So where -- where it is possible to parse out sales at a county level, it is not possible to do so for detailing. So I did not test that.

BY MR. ROTH:

Q. Okay. Professor Cutler takes your percentage, though, and applies it to his regression, which is done at a county

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level; is that right?
MR. SOBOL: Objection.
A. Professor Cutler's calculations, once he has looked at the effect of shipments on harms, he then applies my percentage to that, yes.
BY MR. ROTH:
Q. Did you have any conversations with Professor Cutler about the fact that he was taking your national model and then applying it to his county model and what that might mean for his results?
MR. SOBOL: That's a yes or a no.
A. Yes.
BY MR. ROTH:
Q. Did you have any of those conversations outside of the presence of counsel?
A. No.
Q. Do you have any view about the propriety of taking a national model as you've done and then inputting that into a county-specific model as Professor Cutler has done?

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A. Yes. I believe the national model is appropriate. Again, because marketing strategy is a national phenomenon, the national data are a reliable way to ascertain the relationship between marketing and sales.
I have used the same methodology, for example, in the Neurontin matter concerning Kaiser. We used a national model to estimate the relationship between marketing and sales and applied that to a single healthcare system.
Q. So if marketing is, in your view, nationally done and substantially similar, why is there a difference in shipments on a county level the way Professor Cutler's modeled it?
MR. SOBOL: Objection, scope.
A. This of course is the subject of Professor Cutler's report, and I -- I'm not sure as I sit here I could tell you exactly the factors, but it is obviously counties are situated differently in ways that he captures in his cross-sectional model of harms that could absolutely affect the

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shipments in that county, conditional on marketing.
BY MR. ROTH:
Q. Put another way, though, you would not expect differences in shipments across counties to be caused by marketing where you presume all marketing is national in scope?
MR. SOBOL: Objection.
A. I don't believe that that's the right way of looking at it. So if there's a specific relationship between marketing and sales and -- it could well be that counties start at different levels of use, and so the incremental effect of those relationships, as you see in Professor Cutler's analysis, materializes differently in those counties.
That doesn't mean the effect of marketing was different. It's just the baseline was different.
BY MR. ROTH:
Q. But I think you said that's an issue you would defer to Professor Cutler. You don't have an opinion on how your national model plugs into his county model

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and why the differences may occur in shipments?
MR. SOBOL: Objection.
A. It's my opinion that it's appropriate to take my national estimates. National-level analysis is the most robust analysis. It's the place where the data are really reliable. I think it's appropriate for Professor Cutler to use those estimates in the way that he has.
BY MR. ROTH:
Q. But you have no opinion that explains why we may be seeing variation between county-level shipments in his model despite him using your national model on marketing?
MR. SOBOL: Objection, asked and answered.
A. I do not have an opinion specifically on that, no.
BY MR. ROTH:
Q. You do not attempt to link any specific prescription to any specific defendant's marketing; is that fair?
A. Are you asking me whether I'm

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looking prescription by prescription, these ones were caused and those ones were not? The analysis -- the but-for analysis is a world that did not occur, of course. Would you agree?

The but-for world where the marketing didn't happen, didn't happen. So my analysis can tell me about the correct aggregate amount. It does not identify one prescription at a time.

Q. Okay. Yeah. Just so the record is clear, we've been through this, but you did an aggregate model. You didn't build it from the ground up on a prescription-by-prescription, detail-by-detail basis?

MR. SOBOL: Objection.

A. Right. If I may, the -- I did an aggregate model. The aggregate sales of course are the sum of individual prescriptions, but I am looking at the national level at total marketing on total sales.

It's not that it's unknowable what those prescriptions were underneath the

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sales data. That's not the -- that's not the challenge. The challenge is a conceptual one.

The but-for scenario didn't happen, so I cannot say precisely which prescriptions would not have been written, only that there is some group of them.

BY MR. ROTH:

Q. I know you said earlier you looked for manufacturer-specific detailing notes and marketing information. Did you find or learn of any manufacturer-produced data on detailing to specific doctors within Summit or Cuyahoga County?

A. I don't recall.

Q. And it's fair to say if that does exist, it's not something you reviewed or relied on for Attachment B?

MR. SOBOL: Objection.

A. I did not use individual physician-level data, no.

BY MR. ROTH:

Q. And individual physician-level data, as you may have used in other cases, would be drug specific and doctor specific,

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correct?

MR. SOBOL: Objection.

A. Well, it depends on really what you're talking about. When I have had individual physician-level data in the past, they are sales data. So again, I think the challenge is not disaggregating the sales data.

There are products that exist; sometimes they require subpoenas to get them, but there are products that exist that allow us to look at prescribing at a physician level, but not at detailing at a physician level. So those data I have not used because I have not seen them.

Q. Well, but, for example, an individual manufacturer may keep detailed call notes of the doctor visits that their sales representatives engage in, correct?

A. Well, I have seen call notes in the past, and I have always found them to be unusable.

Q. And why is that, out of curiosity?

A. They often do not include

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provider identifiers, so they can't be linked to other data. They are incomplete, and they -- they are often produced -- so incomplete in the sense of the call notes have a lot of blank fields, and they're often produced for short time periods.

Q. But you didn't look at any individual manufacturer call notes in this case in conjunction with your expert report or opinions?

A. I looked to see if there was a source of complete data for -- in order to do such an analysis, and my staff worked with counsel to identify documents or databases and did not find any.

Q. Pivoting back to Professor Cutler for one more second. Have you worked as an expert in other cases where you've only modeled causation and then another expert has taken that forward and put into it a damages model as Professor Cutler has done here?

A. Yes.

Q. And what case was that or cases, if there's more than one?

A. Yes. In Neurontin, I did the

same, in that order. In other cases I've done the reverse where I've done damages and someone else has done causation.

Q. Okay. And in Neurontin or those other cases, whether you were on the causation side or the damages side, have you before encountered the issue you have here where you have a national model and then a localized model communicating with each other to calculate damages?

MR. SOBOL: Objection.

A. Yes. As I noted earlier, in Neurontin, I used a national model to connect to damages for Kaiser.

BY MR. ROTH:

Q. And the damages -- you used a national model, but what was the damages model based on? What was it localized, or was it also national?

A. It was localized. It was based on Kaiser.

Q. Based on a single company it sounds like you're saying. When you say Kaiser, what do you mean?

A. Yes, that's right. Kaiser was

the plaintiff in that matter.

Q. Right. But that wasn't a model of geography. That was a model of damages to a particular company's sales, I would assume?

MR. SOBOL: Objection.

BY MR. ROTH:

Q. So for a typical -- an insurer, right. Kaiser is an insurer? Am I right about that?

A. Kaiser is a group health plan, so it is both a delivery system and an insurer, all rolled into one, and it is geographically distinct.

So Kaiser is not like United. It is not everywhere diffusely. It is largely in California and the Pacific Northwest with a few smaller sites elsewhere.

So again, those were national estimates and those were connected to damage calculations for a particular payer and delivery system.

Q. And do you recall how they were connected in that case? Were there any kind of localization factors taken into account or any way to differentiate the national level

marketing from where the damages were being calculated?

A. As I sit here, I can't recall all the calculations. I believe, again, I produced the same kinds of but-for percentages and passed those along to the damage model.

Q. Okay. Other than the Kaiser case, can you think of any other examples like that one?

A. Not absolutely, but it wouldn't surprise me if I had done something like this before. I have been involved in some state cases. I just can't recall.

Q. Okay. What is regression analysis?

A. Regression analysis is a statistical methodology that uses data to try to understand the relationships among variables, and in particular, to identify the effects of certain explanatory variables on some dependent variable of interest.

Q. And what is a time series regression?

A. A time series regression is a

model that looks at these patterns over time, so how -- how changes in these explanatory variables over time explain changes in the dependent variable over time.

Q. Your direct model in this case is a time series regression?

A. That's correct.

Q. When is it appropriate to use a time series regression model?

A. As in cases like this one where there are dynamic relationships among the variables of interest, and what I mean by that is that marketing has an effect that is path dependent. It depends on what happened in the last period as well as this period.

Q. What are the other types of regressions you could run, apart from a time series regression?

MR. SOBOL: Objection. You mean like here or like is she capable of?

THE WITNESS: I was going to ask you that question.

BY MR. ROTH:

Q. Generally in the world --

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generally in the world, you've got a time series -- so the way I think about this, right, you've got regression analysis, and one type of regression analysis is a time series regression, okay? Are you with me so far?

A. Okay. I'm with you.

Q. What are the other types of regression analyses that one could perform? I'm not asking specific to this case. Just in the universe.

A. There are cross-sectional regressions, panel data regressions. There's machine learning.

Q. Okay. And what is a cross-sectional regression?

A. A cross-sectional regression is like the one we run in the indirect model, which is looking at a set of observations where there's no time dimension. We're just looking across observations at a point in time.

Q. That Datta and Dave article we looked at, how would you classify that regression they ran?

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A. That's a panel model.

Q. Okay. And what --

A. They call it longitudinal, but I would call it panel.

Q. And what is a longitudinal or panel model, assuming those two things are the same?

A. It has multiple observations per unit of time, but also multiple units of time.

Q. And when is it appropriate to use a cross-sectional model?

A. Well, I think it's sort of hard to say in general, but, I mean, it's hard to say without being reductive. We run cross-sectional models when we want to understand cross-sectional relationships. So there may be things like gender, for example, that typically don't vary over time. I should say sex doesn't vary over time.

So we may want to understand the relationship between sex and wages. We would run that cross-sectionally. That's not something where we necessarily need a time dimension.

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So cross-sectional models are often used for these kinds of immalleable features that we're trying to understand as opposed to things that can change.

Q. When would it be appropriate to use a panel data model?

A. You know, in theory, you can answer many of the same questions with all of these models, but a panel data model allows one, as we were looking at with the Datta and Dave paper, allows one to understand the effects of the individual units, particularly in the way that they do, which is mostly by looking at the variance around those individual units as opposed to the characteristics of the physicians, and looking at decomposing that -- that variance against something that's operating in a time series way and being able to tease those two things apart as they do.

Q. Did you consider running either a cross-sectional model or a panel data model in this case?

A. My belief is that an aggregate time series model is the appropriate model

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for the question at hand, so as I have done in other cases, I selected the aggregate time series model.

MR. SOBOL: You both just meant on the direct side, right?

MR. ROTH: Correct. Good clarification.

BY MR. ROTH:

Q. Why did you believe that the aggregate time series model was the appropriate model for your direct approach for the question at hand?

A. Because, as I mentioned in describing the general purposes of these alternative types of models, the key relationship I'm interested in is this path-dependent relationship between marketing and sales, and aggregate time series model is -- zones right in on that. So that's exactly what it's looking at.

It's not trying to understand some of the mechanisms that Datta and Dave are looking at. I want a model that will capture this total effect as reliably as possible.

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Q. Do you agree with the statement that although a time series correlation may be striking, it does not necessarily determine a causal effect?
A. With any regression model, economists will need to use theory and tests and judgment to determine causality. So there may be time series relationships that are not causal, yes, that is correct.
Q. And do you agree that when there's a slow-moving trend in one variable through time, it is very difficult to infer its causal effects on another variable?
MR. SOBOL: Objection.
You can answer.
A. I believe that you're describing again the well-known limitations of any time series model, and there are ways to examine those challenges.
So again, we first have to start with an appropriate theoretical model. Of course, you could put two variables that trend together in a model and there's no sensible relationship, and clearly that would be spurious.

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On the other hand, marketing is clearly designed to increase sales, so we start with the theory. And in developing the model, we examine the kinds of time series questions that you just raised with that comment.
BY MR. ROTH:
Q. I mean, in some ways the conclusion that marketing influences sales is tautological, right? If you're marketing correctly, you should be increasing sales.
MR. SOBOL: Objection.
You can answer.
A. I don't think that's tautological. It is -- to an economist, again, we would start with economic theory, and if you take the theory of profit maximization and put marketing in that context, it would only make sense for marketing to be undertaken if it increased sales.
I think as a noneconomist, if you grab someone on the street in Boston and ask them why do companies market, they would agree with that basic premise, right? So

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that's -- that's the starting place.
It's not where we end the discussion, but I wouldn't say it's tautological. I would say it's theoretically consistent.
BY MR. ROTH:
Q. As an economist, if companies are rational actors, they're not going to spend money on marketing if they don't have some sales increase.
A. I would agree with that statement, yes.
Q. What are the standard diagnostic tests you perform in running time series regressions?
A. In this model, of course, you can see that we looked particularly about the fit of the model over time and where -- I'm picturing in my head the chart with Model A on it where we had a single coefficient for promotional effectiveness, and clearly we were departing from the underlying data, so those kinds of tests we conducted Wald tests, two-dimensional Wald tests to examine the appropriate turning points, and likewise,

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because part of this time series model of course is the stock of marketing and its appropriate depreciation rate, we conducted statistical tests around that as well.
Q. So you answered about this model, which I want to get to.
A. Sure.
Q. But I'm talking generally when you do time series models, what are the standard diagnostic tests you might be perform, whether or not you actually did it in this case?
A. Right. I don't believe that they're reported here, but early on in looking at the data, we looked for -- we looked at a Dickey-Fuller test, which is basically testing for unit roots.
I'm thinking about the simple explanation goes to what you said before about two slow-moving trends and whether there might be spurious correlation, and we found that those concerns were not warranted based on the Dickey-Fuller results.
MR. SOBOL: Can you spell that?
THE WITNESS: Dickey,

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D-I-C-K-E-Y, dash, Fuller.
MR. ROTH: F-U-L-L-E-R?
A. Yes.
BY MR. ROTH:
Q. What is nonstationarity?
A. Nonstationarity relates to that unit root. It has to do with the trends -- that these two trends are moving together.
Q. The mean or variance of the variable is not constant over time?
A. It's -- again, it's related to the way the variable of interest and the right-hand side variable are regressing together, so it has to do with the variance over time.
Q. And why is nonstationarity an issue with time series models?
A. If you have this problem, which again, we do not, then you can get spurious results.
Q. Do you know when your team or you performed the Dickey-Fuller test?
A. I believe it was early on in the analysis that we were doing.
Q. Okay. And do you have the

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results of those tests somewhere that you could produce to us?
A. I do not.
Q. And why is that? Is it a computer model test that...
A. Generally we don't save the log files for those kinds of tests.
Q. Okay. Could one be performed using the backup data you've produced?
MR. SOBOL: Objection.
A. Yes, I believe so.
BY MR. ROTH:
Q. Do you know if the MME prescriptions in your model are stationary?
A. As I sit here, no.
Q. Do you know if the stock of detailing variable is stationary?
A. Again, as I sit here, no.
Q. And would the presence of nonstationarity lead you to overstate the impact of promotion in your direct model?
A. Well, again, if the -- if there was a unit root problem, then it could overstate the results, yes.
Q. And I assume because your

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Dickey-Fuller test showed no unit root problem, you did not make any effort to correct for nonstationarity?
A. That's correct.
Q. What is autocorrelation?
A. Autocorrelation is essentially when the residuals from one time period are correlated with the residuals from the next time period, so autocorrelation from period to period.
Q. And autocorrelation can overstate the impact of a predictor variable?
A. No, that's not quite correct. Autocorrelation can affect the standard errors. It does not bias the coefficient.
Q. Could the presence of autocorrelation lead to an overstatement of the impact of an independent variable?
A. No, the presence of autocorrelation could lead to an overstatement of the statistical significance of an independent variable, but not its effect.
Q. Did you run any tests to detect autocorrelation in your direct model?

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A. I believe there were some tests for autocorrelation also early on when we were beginning our work, and we found that, particularly in the late period, that while there was some early autocorrelation, that the autocorrelation goes away in a later period of the data, and we did not correct for it.
Q. Is that a Durbin-Watson test?
A. I believe that is a Durbin-Watson.
Q. Do you have the results of that test readily available, or no, because you didn't save the log file?
A. As far as I know, the log file was not saved.
Q. But again, that's a test that could be replicated on your model with the backup data that you've provided?
A. Yes, it could be.
Q. When is it appropriate to aggregate versus utilizing cross-sectional information in putting together a regression?
MR. SOBOL: Generally?
MR. ROTH: Correct.

A. Well, aggregation has a number of advantages in specific contexts. I would say -- go back to my first answer, which is we are interested here in an aggregate question. If you were interested in an individual question, you wouldn't aggregate.

So we are at first principles interested in the -- I am interested in the impact of opioid marketing in this class on sales, and so I start there.

Aggregation can provide benefits in that it cuts down on certain kinds of noise, and it also -- it steps away from certain kinds of endogeneity problems, but I'm sure we will talk more about -- but we talked a little bit about --

BY MR. ROTH:

Q. How did you know?

A. -- in terms of Datta and Dave, the endogeneity problem that they're interested in is that physicians who have a propensity to prescribe your drug are the ones you detail. But when we aggregate, when we go up to the aggregate level, we don't have that same endogeneity problem, so...

Q. Thank you for saying endogeneity before I did so I made sure I got it right. And we will talk about it.

But is it also true that aggregation can sometimes mask patterns in the data?

A. Well, yes, but you have to be interested in those patterns for that to be a problem. So if, in fact, there are patterns in the data, my task as I understand it is to look at the aggregate effect of marketing, so that's just not a question that I was particularly interested in here.

It's true that an average effect will mask differences, if there are any.

Q. Okay. So going back to paragraph 11 of your report.

A. Yeah.

Q. This is your summary of opinions. Do you see that?

A. Yes.

Q. And you also have a handy chart, which we'll talk about later, but I just want to focus on paragraph 11 first.

A. Yeah.

Q. So the last bullet on page 8 says: Using econometric models, I demonstrate that I can reasonably identify the extent to which the sale of prescription opioids measured by the number of milligrams of morphine equivalents, or MMEs, was caused by any quantum of the defendants' promotional efforts that counsel can prove was unlawful.

Do you see that sentence?

A. I do.

Q. And we'll get more into the specifics on that, but how is that so, where your assumption was that everything was unlawful? How could you particularize your model to any quantum that counsel proves?

MR. SOBOL: Objection.

A. Sure. My Table 3 does that, for example, by backing out individual defendants and saying, okay, let's just assume that, in fact, defendant X was not involved. So it can be done that way.

It could be done propositionally. It could be done by saying, no, it wasn't 1995; it really didn't start

until 2000. That's what I mean by "any quantum," is that we could divide the marketing in any measurable way over my model.

BY MR. ROTH:

Q. What if the quantum of promotional efforts that counsel proved unlawful was influencing key opinion leaders to change prescribing standards, how would your model be used to evaluate conduct in that situation?

A. I haven't been asked to look at that, so I'd need to really give that some thought. I wouldn't call that a quantum. I would call that something else, and I'm not going to make up words, but that's more of a sort of qualitative piece. But in theory, that's possible. I have not looked at that.

Q. And that's a good clarification. When you say quantum, you mean quantitative, not qualitative, right?

A. That's what I meant, yes.

Q. So you could take out specific defendants or percentages, but you could not modify your model using a qualitative test

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for unlawfulness to determine what the impact is?
MR. SOBOL: Objection.
A. I would not conclude that without giving some thought. I'm sure it couldn't be done for every qualitative example that you could come up with, but I think that there are ways of doing it qualitatively, as I, again, did in the Neurontin matter, looking at promotion to psychiatrists as opposed to other physicians.
BY MR. ROTH:
Q. But since you have an aggregate national model with aggregate detailing, is there a way to go, for example, and figure out where the details only to dentists were if the court concludes that that was the unlawful activity as opposed to detailing writ large?
A. I'm not a hundred percent sure about dentists, but as I used in the Neurontin matter, there are detailing data available that would allow you to look nationally by specialty.
Q. But the detailing data you used

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in the Neurontin matter for that exercise is not the same detailing data you used in this matter for your direct model, correct?
A. It's not exactly the same because it was disaggregated by specialty, but I believe those -- that is possible to disaggregate by specialty. I've not done that here.
Q. And you haven't even tested whether it can be done yet, right?
MR. SOBOL: Objection.
A. I have not.
BY MR. ROTH:
Q. I'll give you a quantitative measure. What if the court concludes that any detail over five minutes in length were presumed unlawful, but anything shorter than that isn't? How can you quantify the impact of the over-five-minute visits in your model?
A. As I sit here, I don't know because I haven't thought about it. Clearly I would need some data on the length of details.
Q. We'll come back to this, I promise, but back to paragraph 11 for a

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minute.
So on page 9, the bullet says: Based upon my analyses and assumptions from counsel about the extent of promotion that can be proven to be unlawful, I can reasonably identify approximately 45 to 67% of MMEs during the period of my analysis as caused by unlawful promotion.
Did I read that correctly?
A. You did.
Q. And the 45 is the direct number, and the 67 is the indirect number from your models?
A. That's correct.
Q. Okay. And then if you look at paragraph 75 -- and we talked about this earlier already. But paragraph 75, which is on page 50 under Calculation of But-For MMEs.
Do you see that?
A. Yes.
Q. You say: I have been instructed by counsel to assume in my but-for scenarios that the fact finder, judge or jury, finds that all or virtually all promotion by the manufacturer defendants from

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1995 to present was unlawful.
Do you see that?
A. Yes.
Q. And then after the parentheses, it says: Thus, to calculate impact for the purpose of damages beginning in 2006, I modeled a world in which this promotion did not occur, i.e., but-for promotion equals actual promotion for opioids, less all promotion for opioids by the defendants and their surrogates.
Do you see that?
A. I do.
Q. And then in Table 2 on the next page, there's actually a note that says: The percent of MMEs attributable to challenged promotion is calculated as the difference between predicted actual and predicted but-for MMEs, assuming all defendants' promotion is set to zero starting in 1995 divided by predicted actual MMEs.
Do you see that?
A. Yes.
Q. So your model assumption is actually, not virtually, all promotion by

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defendants is unlawful; it's that all promotion by defendants is unlawful?
A. Yes. I guess the -- sort of the legal formulation of that, I'm repeating there when I say all and virtually all. I'm not sure what virtually all would be quantified as, 99%, but I do all, yes.
Q. Okay. And does that not equate to assuming that all MMEs prescribed due to defendants' promotion were medically unnecessary?
A. No, that does not equate to that.
Q. So in your model, you could have unlawful promotion that leads to medically necessary scripts still?
A. I was asked to quantify the impact of the alleged unlawful promotion, not to examine that question about whether that prescription itself was medically unnecessary, so -- so it's something I haven't looked at and I don't believe it's related to my charge.
The fact that the promotion was unlawful to me does not equate to the fact

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that a prescription was medically unnecessary.
Q. So if promotion, whether lawful or unlawful, results in a medically necessary prescription, how does that prescription cause damage?
MR. SOBOL: Objection, scope.
A. I'm not a lawyer, as you know. And sort of what the theory of liability is and what -- what plaintiffs can recover for and what they can't is -- I do not know.
I have only been asked to examine the extent to which this unlawful conduct caused sales.
BY MR. ROTH:
Q. Okay. You're not a lawyer, but you're a good economist. You've testified a lot about causation and damages, okay, and you're familiar with what a but-for world is, right?
A. Yes.
Q. You have one here?
A. I do.
Q. So how does your but-for world treat medically necessary prescriptions?

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A. Again, this is --
MR. SOBOL: Objection.
But go ahead.
THE WITNESS: Sorry.
A. The model treats the right-hand side variable as the thing that will be proven to be unlawful, and any sales gained from that unlawful conduct as subject to recovery. This I know as a, thank you, good economist and someone who's done that, that downstream of my analysis there's a damage number that plaintiffs I believe will try to recover.
So as an economist, to me, the theory is that any gains, whether or not they resulted in medically necessary prescriptions, are subject to recovery. As an economist, that seems like a reasonable theory if we wanted to deter fraudulent and misleading information. This is the same analysis that I did in the Neurontin case.
BY MR. ROTH:
Q. Stated differently, your model will calculate causation by defendants' marketing even for medically necessary

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prescriptions?
A. It does not distinguish. And to be clear, whether or not there were medically necessary prescriptions caused by the misconduct, I can't say for sure.
Q. And as an economist, is that not something you think you should take into account in your but-for world where you're opining that but for the defendants' conduct, fewer of these MMEs would be out in the world?
A. Absolutely not. Again, as an economist, to me, if the allegations are true, I can see a strong economic rationale for ensuring that liability is attached to all these ill-gotten gains from the alleged misconduct.
Q. But there is a parallel world where a manufacturer may promote lawfully and that lawful promotion would result in medically necessary prescriptions, correct?
MR. SOBOL: Objection.
A. I -- you have a lot of parallel worlds I've noticed, but yes, I think we agreed at the beginning of the day that there

is such a thing as lawful marketing, and it does generate sales.

Some of those sales may be medically necessary, some may be medically unnecessary, even if there's no unlawful conduct.

BY MR. ROTH:

Q. I asked some of these questions, but I did promise I'd come back.

How would your model work if the court finds that only detailing visits where the representative spoke about addiction risk were unlawful?

A. I don't know the answer to that question. I have not thought about how one could parse that out, so I don't know as I sit here.

Q. You did mention time could be quantified, so I guess to clarify, would you be able to calculate causation if the court found, for example, that only detailing that happened between 1996 and 2000 were unlawful?

A. Yes, my model is capable of doing any combination of manufacturer and time.

Q. What about drug?

A. And drug.

Q. Okay. So you could do -- you could take out manufacturers, right?

A. Yes.

Q. You could take out drugs?

A. Yes.

Q. And you could take out years?

A. Yes.

Q. Okay. Beyond that, is there anything you can take out of your model?

MR. SOBOL: Objection.

A. Well, as I said earlier, I believe that it's possible to take out physician specialties.

BY MR. ROTH:

Q. Right. And we talked about that. But you're not certain it can be done, and you haven't tested it yet?

MR. SOBOL: Objection.

A. I haven't tested that.

BY MR. ROTH:

Q. What if the court finds that only off-label marketing was unlawful? Is there any way your model can be adjusted to

account for just the unlawful off-label detailing?

A. I assume that you're talking about specific off-label messages. Again, I haven't -- I haven't thought about how the detailing itself could be parsed in that way. There would need to be another source of information for that to be possible.

Q. You need a different dataset basically?

A. Yes. The thing with detailing is that it's a face-to-face visit, so we can see what messages the detailer brought on paper with them but not what came out of their mouths.

Q. What if the court finds that only journal advertising were unlawful? How would your model account for that?

A. Well, as I believe I say in my report, the journal advertising data is very spotty for these drugs, so I've not included that as a separate factor. It's already out of my model. I would have to give that some consideration.

Q. Okay. If we look at

Attachment D, which is towards the back, I want to go to page D6. And there's a section at the bottom --

MR. SOBOL: I'm sorry. Wait.

MR. ROTH: D6 of Attachment D.

MR. SOBOL: Is it the table?

MR. ROTH: No, it's the text. It's the technical write-up of the regression.

THE WITNESS: Yeah.

MR. ROTH: I feel like it's always Attachment D in every case, by the way.

THE WITNESS: Is it? Interesting.

BY MR. ROTH:

Q. Are you in Attachment D, D6?

MR. SOBOL: It's just the same attachment.

A. I am.

BY MR. ROTH:

Q. It's all in the same report, right?

A. You didn't notice? Yeah.

Q. Well, Tom is involved for sure.

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All right.
So looking at Attachment D, page D6. This may be from one of the same attachments. I don't know. Do you see there's a section that says Comcast Considerations?
A. Yes, I do.
Q. What is the reference to Comcast there?
A. Well, again, I'm not lawyer, but I understand that there was a case involving Comcast, and that the -- what it concerns, again, from a layperson's understanding, is about the ability of the damages as presented to the court to conform to different conclusions about the but-for scenario.
Q. Essentially the issue we've been talking about for the last --
A. The issue we've been talking about.
Q. And why were you concerned about the application of Comcast to this case?
MR. SOBOL: Objection, assumes

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a fact not in evidence.
BY MR. ROTH:
Q. Assuming you were.
A. As you recall, the last part of my assignment was to report on how my conclusion would be different if there were different considerations with regard to who's in, who's out by defendant, for example. So yes.
Q. Okay. I'm trying to streamline here because we've covered more ground --
A. We're going to cover 14 hours no matter what --
Q. That's true.
A. -- so streamlining may be good for you, but it's not good for me.
MR. ROTH: I'm having fun. I think you are too.
THE WITNESS: Of course.
MR. LONERGAN: What about us?
BY MR. ROTH:
Q. Do you agree that your model does not measure the impact -- we went over this. I'm not going to ask that again. Strike that.

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Could you have modeled an individual manufacturer separately?
MR. SOBOL: Objection, asked and answered.
A. It was not something I attempted to do. I think mechanically it is possible. But as I noted, one of the reasons for using an aggregate time series is that we smooth over a lot of noise in the data, so I don't know whether an individual manufacturer-level model would be feasible.
BY MR. ROTH:
Q. Okay. In a but-for world, where all of the unlawful detailing, which is your assumed all defendants' detailing, were replaced with lawful detailing, would there be any change in overall prescribing?
A. Sorry. I just -- so the model doesn't itself have a presumption about lawful and unlawful. The but-for scenario is where that presumption is incorporated, so the model is the model.
Q. I asked a bad question and you properly called me on it. Let me ask a better question.

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If we assume that all unlawful detailing is lawful, then the actual prescribing and the but-for prescribing in your models would be equal to each other?
A. Yes, that's correct. Those two predicted values would be identical.
Q. So the percent of MMEs attributed to unlawful detailing in that scenario would be zero percent.
A. Yes. If marketing were the same in both scenarios, then there would be no difference.
Q. Assume for a minute that a manufacturer's detailing is found to be unlawful but it did not engage in any of the other marketing misconduct alleged by plaintiffs with respect to the key opinion leaders, journal advertising and the other factors.
How would your model account for harm for that specific manufacturer?
MR. SOBOL: Objection.
A. In my opinion, that would be a legal question because, again, all the manufacturers are operating in the same

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ecosystem. According to the complaint and everything I know as a health economist, the effects of one manufacturer's unbranded marketing -- I use that to refer to the guidelines and those kinds of activities -- will spill over on to another manufacturer, and I don't know whether it would be appropriate to pull that out or not.

BY MR. ROTH:

Q. That's a long answer. I want to -- I think I asked a more specific question.

A. Sure.

Q. So if detailing is unlawful --

A. Yes.

Q. -- and let's say also the other stuff, okay, key opinion leaders influencing standards of care is also unlawful, and a manufacturer just detailed, they're going to have the same percentage of liability in your direct model whether or not they engaged in the other unlawful conduct, correct?

MR. SOBOL: Objection.

A. Yes, that's true. Although it's true in terms of what I calculate in

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Table 3. Just to be clear, I don't have an opinion on liability. That's a legal matter. But what I do in Table 3 is I say, okay, well, what would happen if we said the detailing by Purdue were lawful, what would happen there?

So whether or not that quantum is exactly what liability is, I don't -- I don't really know how the court is going to see that, and so that's why I don't really know if you would need to say, well, some of why your detailing was so productive was caused by somebody else's activity. I don't know whether it would make sense to back that out.

BY MR. ROTH:

Q. So let's take the opposite.

A. Yeah.

Q. Someone's detailing is entirely lawful. There's no issue there. But they've influenced the standards of care through key opinion leaders, they've paid off doctors, they've done all of the parade of horribles that the plaintiffs allege, and the court finds that that in fact is unlawful. In your

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model, that manufacturer has no liability, correct?

MR. SOBOL: Objection.

A. Well, again, my model is looking at the aggregate causation between marketing and sales; it is not designed to assign liability to individual manufacturers nor, again, am I certain how counsel or the courts would do so.

The purpose of Table 3 is to show that I can back out individual levels of detailing, not to assign liability. So I -- I don't know exactly how that would proceed, even -- even without having these variable assumptions across defendants. I have not looked defendant by defendant at something like liability.

BY MR. ROTH:

Q. Okay. So let's look aggregate.

If for all the manufacturers the conclusion is that the detailing is entirely lawful, but the manufacturers engaged in other conduct that the court finds is unlawful, what would the result of your model be in that world?

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MR. SOBOL: Objection.

A. I would have to give it some thought, but again, my preferred model ultimately captures the effect of all that other stuff that we're calling as really is the what happens -- in part, a chunk of it is what happens to the promotional effectiveness after the first turning point and before the second turning point. And so in theory, one could look at that, but it would really depend on the specific set of facts.

BY MR. ROTH:

Q. It would require a new model probably?

MR. SOBOL: Objection.

A. I don't know that it would require a new model. It would require a new but-for analysis.

BY MR. ROTH:

Q. Back to your body of your report, paragraph 64. You say: The econometric analyses serve two purposes. First, they indicate that in economic terms there is a causal relationship between the defendants' promotion and prescriptions of

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opioids so that if the allegations of misconduct are proven true, impact can be found.

Do you see that?

A. Yes.

Q. But you actually didn't assess specifically a causal relationship between promotion and prescriptions, right? Those are not the two variables on your X and Y axis?

MR. SOBOL: Objection.

A. Well, I look at the stock of detailing, which I argue and believe is a reasonable proxy for promotion. It is not, strictly speaking, all promotion. To the extent that it is measured with error, it understates the effect of promotion.

BY MR. ROTH:

Q. If we wanted to be precise, though, what your model actually shows is a correlation between detailing and MMEs?

MR. SOBOL: Objection.

A. Well, as we talked about earlier and will no doubt talk about again, any regression analysis can have a causal

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interpretation or not, depending on a number of factors.

I interpret this regression analysis as showing causation between marketing and sales, and it does, in fact, use detailing contacts as the measure of marketing.

BY MR. ROTH:

Q. And if we want to be even more precise, when we're talking about defendants detailing, we're talking about all detailing without distinguishing between lawful and unlawful as we've talked about?

MR. SOBOL: Objection, asked and answered.

A. For the purposes of my analysis, I've been asked to assume that all detailing in this period was unlawful, so that distinction is not relevant.

BY MR. ROTH:

Q. So your model does not analyze causation between the false promotion as alleged in the complaint and the number of MMEs prescribed?

MR. SOBOL: Objection.

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A. I would disagree. That is exactly what my model does. Again, we can agree that I have not separately proven that that detailing was unlawful, but I understand that counsel for plaintiffs intend to prove that, and so I have undertaken to examine the causal effect of that allegedly unlawful conduct.

BY MR. ROTH:

Q. Which is all promotion by defendants?

A. Which is all promotion by defendants from 1995 to the end of my data.

Q. And when does your data end?

A. Mid 2018.

Q. Okay. Do you plan on updating it if we go to trial in 2019 to take us through today?

MR. SOBOL: Objection.

A. I haven't been asked to do that. I don't know if I would be asked to do that.

MR. ROTH: Why don't we take a break, because I realize we've probably covered some of these next

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questions and I can streamline.

THE WITNESS: Okay.

THE VIDEOGRAPHER: The time is 10:58 a.m. We're now off the record.

(Recess taken, 10:58 a.m. to 11:13 a.m.)

THE VIDEOGRAPHER: The time is 11:13 a.m. We're back on the record.

BY MR. ROTH:

Q. Professor Rosenthal, if you would please turn to paragraph 59, which is on page 42. All right. So we're going to go step by step here.

A. Okay.

Q. You say: My primary dependent variable, the outcome to be explained, is the number of MMEs for all drugs at issue in this matter.

Do you see that?

A. Yes.

Q. Okay. Why did you look at MMEs as opposed to prescriptions or some other measure?

A. Sure. Because, as I note in this paragraph, the intensity of the medicine

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that the patient is getting is a function not just of the number of prescriptions, but the number of pills and the strength of those pills, and specifically the milligrams of morphine equivalence is a way of being able to cross-walk across drugs that have different -- I'm going to use the term "strength." I'm not sure that would strictly be correct, but different strength in terms of how much morphine they deliver.

Q. You agree that doctors prescribe drugs, they don't prescribe MMEs to patients?

A. They prescribe drugs, dosages, durations, all of which translate into MMEs.

Q. And if you're looking at things in terms of MMEs, you're not breaking it down by drug molecule; is that correct?

A. Well, again, in my analysis as we've talked about, I -- even if I were looking at -- I do a version of the model as you know, that's in Attachment D somewhere, where I look at pills. And I don't distinguish across drugs there either, again, because my goal is to look at the market as a

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whole.

Distinguishing by drugs is not -- it's not unique to the fact that I'm looking at MMEs.

Q. I know you're not a medical doctor, but you do understand that these drugs have different chemical compounds and might have differences in their labeling and indications?

A. Yes, I do understand that there may be some differences, and again, I use MMEs as a common unit of impact, as it were, that is more nuanced than prescriptions or pills but does not distinguish beyond the morphine equivalence.

Q. But because you're looking at MMEs, you're losing data with respect to the length or course of treatment, correct?

A. Well, no. Actually, I'm not specifically looking at the length, but if, for example, patients are getting longer courses of treatment, that will show up as more MMEs.

Q. And similarly, if patients are getting stronger molecules, that will also

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show up as more MMEs?

A. That is correct.

Q. So you could have one patient taking 100 MMEs over the course of ten days and ten patients taking ten MMEs over the course of the same period of time, and your model makes no distinction between those two circumstances?

A. Yes, that's correct. Again, because I am -- I am responsible for looking at the effect of marketing on sort of the quantity of morphine equivalence that were out in the world. Whereas Professor Cutler is then going to look at the effect of those MMEs on harms, and his model will establish the relationship between MMEs and harms.

Q. So if the court, for example, found that certain dosages were more prone to abuse, okay, or dosages given over a certain period of time are more prone to abuse, would you have any way in your model to drill down on that distinction and segregate out the, quote, lawful MMEs that don't fit whatever definition the court crafts on that?

A. It seems to me that you've put

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two things into your question, so maybe it's just I don't understand the way you used the terms "if the court determines."

So if the court determines that certain packaging is subject to abuse, but are you saying that the court determines that any --

Q. Let me try it again.

A. Yeah.

Q. Suppose the court or jury finds that messaging related to higher-dosage drugs was false but messaging for lower-dosage drugs was not, how would your model that looks at total MMEs account for that?

A. Well, if I understand you correctly, you're asking again about whether I could narrow down my analysis by drug, which I can do.

Q. Not by drug, but by MMEs, if it were by drug and strength?

A. Yes. So the observations ultimately -- I can see you haven't played around with the enormous dataset, but they ultimately go to the NDC level, and an NDC code is a drug, manufacturer, strength,

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formulation, I think those four dimensions.
Q. Okay. But what if it's strength over a certain period of time in the prescription? What if it's, you know, 400 milligrams for a week or more is a problem, but less than 400 for a shorter period of time is not?
A. I think you're confusing again inputs and outputs here, so -- of course, I can't -- I don't presume to know what the court would think. But as we talked about before, what I'm really looking at is the effect of some set of marketing efforts on all the prescriptions that flowed from it.
So it's hard for me to imagine that the court would say, yes, the conduct was unlawful but some prescriptions that flowed from it we won't count against damages and some we will. And so --
Q. You can't conceive of that happening?
A. It's just not clear to me. It just seems, again, as we talked about before, I'm not a lawyer, so I don't know exactly how liability would work that way.

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My analysis is really intended to look at all MMEs. To the extent that only MMEs that were packaged a certain way, if that's my shorthand for, you know, dose and duration, for a given patient at a given point in time, if -- if those are the only things that create harms, then Professor Cutler will find a very weak relationship between the MMEs and the harms that he's looking at. I don't believe that's what he finds, but that question could have a downstream effect, but I know of no theory like that.
Q. Okay. When you mentioned the drugs at issue in this matter, what are the drugs at issue in this matter?
A. Well, it's a very long list. They're in Attachment C, if you'd like to go through them with me.
Q. We don't have to go one by one, but the drugs contained in Attachment C is what you mean?
A. Yes.
MR. SOBOL: We could spend an hour or so doing that.

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BY MR. ROTH:
Q. So -- but if I understand, though, the drugs contained in Attachment C are just drugs that someone has associated with one of the manufacturer defendants in this case, correct?
A. I actually need to look at Attachment C to see that it doesn't have an "all other" category.
Q. It may. Take a minute to look for it, if you want.
A. Yeah. Yeah, I will.
(Document review.)
A. I think Table C.1 is all of the drugs. It's not listed by manufacturer, but it has all the drug names.
BY MR. ROTH:
Q. So these are all of the --
A. Yes, I believe --
Q. -- chemical compounds?
A. -- these are all the drug names.
Q. Okay. So when you say drugs at issue in this matter, you're referring to the drugs listed in Table C.1?

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A. That's correct.
Q. Now, you say in Attachment D that your intent was to include all drugs that have been scheduled as Schedule II at any point in time; is that correct?
A. That's correct.
Q. Does your model differentiate between detailing visits for drugs that were Schedule III at the time they were detailed but later became Schedule II?
A. It does not.
Q. And did you have any discussion about doing that?
A. I don't recall specifically, but again, I make clear the assumption that because those drugs were rescheduled that they're considered to be Schedule II for my analysis in every way.
If that assumption were proven wrong, it could easily be adapted, as we talked about before. Changing what's in the but-for scenario by drug by year by defendant is relatively straightforward.
Q. So you could take a drug that you've included detailing for prior to 2014,

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for example, when oxycodone -- hydrocodone got reformulated --
A. I could.
Q. -- and take out everything before 2014?
A. That's correct.
Q. And that would change the numbers in Table 3 of your report?
A. Presumably, yes.
Q. So you understand obviously that some opioids have higher potency than others, and that's why you used MMEs it sounds like?
A. Yes, that's correct.
Q. And the conversion factors in your data appendix, which we can look at in a little bit, do you know where you got those numbers from? Was it the DEA website?
A. They mostly come from the CDC actually, but they didn't have all of them, so assuming some of them come from that Excellus document, I'd have to just look at what I cite, but I know we had to go to a second document.
Q. Okay. By definition, a

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prescription of a drug with a higher MME conversion would have a greater impact on overall MMEs?
A. Yes, I think that that is a statement on its face that must be true.
Q. Does your model differentiate between immediate and extended release opioids?
A. My model does not differentiate between immediate and extended release.
Q. And your model does not differentiate between opioids prescribed for short-term use versus long-term use?
A. As we talked about before, I am counting all MMEs, whether they were in a 3-day prescription or a 30-day prescription.
Q. And your model does not differentiate between abuse-deterrent formulations and nonabuse-deterrent formulations?
A. Again, of course, that would be a product-level characteristic. One could do so, but I have not, no.
Q. Your model does not differentiate between a hundred patients each

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taking one MME versus one patient taking a hundred MMEs?
A. For the purposes of my analysis, that is irrelevant. I'm trying to understand the total sales, yes.
Q. And you don't differentiate between product differences like, for example, a fentanyl patch versus a Vicodin pill?
A. I am not distinguishing. Again, I do not include injectables, but otherwise, I include these other formulations.
Q. Otherwise, all MMEs are created equal in your world?
A. Yes. For the purposes of my analysis, I'm counting all MMEs.
MR. SOBOL: In your world.
THE WITNESS: Again.
BY MR. ROTH:
Q. In your analysis, all MMEs are created equal.
A. That's correct.
Q. It's nice that we all get our own worlds.

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MR. SOBOL: "Your analysis," is that one or two words?
MR. ROTH: It's not starting with a U.
BY MR. ROTH:
Q. And you don't differentiate between the indications for which the MMEs are prescribed in your analysis, correct?
A. That's correct. I'm looking at total sales.
Q. Right. So whether an MME is prescribed for surgery or chronic pain doesn't matter for your direct model?
A. As we talked about earlier, I'm really focusing on the unlawful nature of the conduct and looking at all the prescriptions or all the MMEs that resulted from that.
Q. Okay. So now let's look at paragraph 60 of your report.
A. Okay.
Q. Which is the same page we were on, I think. It's on page 42.
A. Okay.
Q. Are you there?
A. Yep.

Q. It says: The key explanatory variable in the model is the number of detailing contacts for opioids.

Do you see that?

A. I do.

Q. And we've been talking about that, that that's sort of what you use for your stock of promotion are the detailing contacts at a given point in time, multiplied by the depreciation factor?

A. That's correct.

Q. And you -- we agree that detailing is just one of a variety of methods a drug company may use to promote its products to physicians?

A. Yes. And again, the data suggest that it's a dominant one here.

Q. If you look at paragraph 66, you say: While the defendants actively sought to manipulate the scientific and popular understanding of the risks of opioids prior to 1999, according to plaintiffs' marketing expert Perri, the release of the American Pain Society and American Association of Pain Medicine consensus

statement on pain, followed by the Federation of State Medical Board Model Guidelines and the Joint Commission on Accreditation of Healthcare Organizations, pain management standards were also important marketing tools.

Do you see that?

A. Yes.

Q. And then you say: Through such advocacy, as well as traditional marketing vehicles, Dr. Perri finds that defendants sought to change the narrative about opioid therapy, opening the floodgates to prescribing.

Do you see that?

A. Yes.

Q. But, again, your model does not look at non-detailing promotion as part of the stock?

A. Non-detailing promotion is not included in the stock; it's incorporated in my model in two ways.

One, in Model B, I used the different eras during which these activities were going on to allow promotional

effectiveness to be either increased or decreased by those factors.

And two, in Model C, I incorporate several of the events to see whether any of that changes my results, and find that they do not.

Q. Did you consider using other measures of promotion beyond detailing as your explanatory variable?

A. I did. I believe there's a footnote somewhere. I just need to find the right paragraph. I know this paragraph moved at one point, so now I can't remember whether it's early or late. Oh, here, paragraph 56.

Q. Yep, I was going to take you there.

A. Okay. Perfect. Well, you just let me struggle instead. Yeah.

So as I note there, IQVIA, where we get the data on promotion, has no spending on professional journal advertisements or direct-to-consumer advertising, and the free sample data seemed very spotty, and from what I could understand, free samples were used

infrequently, perhaps for obvious reasons in this particular class.

Q. On the journal advertisements or the direct-to-consumer advertising, you did look at marketing budgets for the manufacturers, correct?

A. Yes.

Q. They're cited in your report I think in an earlier section.

A. Yes.

Q. Did you consider using those to try to measure journal advertisements or some of these other categories?

A. I think those data would just -- A, they're not monthly, and B, they're -- they're very incomplete with regard to the drugs, right? If we were trying to get this for every drug, we do have product profit and loss statements for specific drugs, and then aggregate marketing budgets for the companies as a whole, but it's simply not precise enough to use here.

Q. Okay. So I want to go through this paragraph carefully.

A. Sure.

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Q. I suspect you knew I would.
So you mentioned that you thought that detailing was the most dominant form of promotion in a prior answer, and, in fact, you write that as your first reason in paragraph 56.
Do you see that?
A. Yes.
Q. And your citation for that is just to Dr. Perri's report.
Do you see that?
A. Yes, and then I go on to describe what the data show.
Q. Right. So that's a good clarification.
So when you're saying it's the most dominant form of promotion, what you really mean is in the data you reviewed, it was the most dominant form of promotion that was tracked?
A. That's correct.
Q. Okay. Do you have any basis to think beyond the data you reviewed that detailing is the most dominant form of promotion in the opioid market by, for

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example, dollars spent?
A. Well, I guess in the product profit and loss statements that I looked at, detailing was clearly in the majority. Obviously -- so the detailing expenditures that you can get in profit and loss statements, they look a little different than what you can get from IMS Health because the sales force is -- is an expense that itself isn't typically dedicated to one product, so there's some allocation, versus the IQVIA data are aggregating up from reported visits.
So they're a little bit apples and oranges, but in the product and loss statements that I looked at, yes, that confirmed my understanding that detailing was certainly the largest marketing tool.
Q. Pausing on the IQVIA data, you don't know that those are limited to one product either, right? There could be a detail where the physician was detailed on five drugs and it gets reported to all five in the IQVIA data?
A. That's correct. So whatever was discussed is what gets flagged for the

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IQVIA data. It could be multiple drugs.
Q. So when you're looking at the IQVIA data for your detailing data, you don't know whether opioids were the focus of the conversation or not, if more than one drug was reported for that contact?
A. If more than one drug was reported, I don't know the specific time allocation.
Q. And you didn't do any analysis to try to dissect that issue?
A. Well, there's no analysis that I could imagine that you could retrospectively go back and figure out what was talked at for how long, and it's not totally clear that time would be the best measure.
So maybe you came and talked about three drugs to me and I was convinced to prescribe on all three of them, so is the detail only one-third as value than the detail dedicated to one of those drugs? It doesn't seem to me that it would be.
Q. Then sticking with paragraph 56, your second reason you focused

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on detailing is pharmaceutical marketing programs typically combine various forms of marketing such that were there to be an increase or decrease in promotional detailing, it is reasonable to expect that some other forms followed that course. And then you go on to say it's a good proxy for that reason.
Do you see that?
A. Yes.
Q. And what is your basis for that expectation, that other forms of marketing follow detailing?
A. Sure. My experience doing research in this area, and particularly using the IQVIA data, the two that are most heavily correlated tend to be detailing and sampling, but there's correlation across all mechanisms where there are data reported for all of them.
Q. Okay. Did you perform any study or analysis on the IQVIA data or any other data in this case to confirm that in the opioid market your experience holds true with regard to how detailing and other forms

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of promotion are correlated?
A. Well, as I mentioned, when I looked at the IQVIA data for journal advertisements, direct-to-consumer advertising, sampling, there was very little data there. I have no reason to believe that they're just not measuring it. It may be that there are some kinds of advertising that we see in the marketing budgets that IQVIA doesn't capture. But to the extent that the IQVIA data are complete, it was not really possible to do a correlation analysis because there was so little data for these other tools.
Q. So when you say it's a reasonable expectation that other forms of marketing follow detailing, that's really just an assumption based on your experience with other drugs in other cases?
A. It's based on my experience with very similar kinds of analyses with other drugs. And again, I cite to Dr. Perri's report at the beginning of this where he talks about the coordination of marketing mechanisms, so it's very consistent

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with his opinions as well.
Q. Yeah. But to be clear, that's an assumption you're making that's not supported by any specific work you've done to confirm it's true that detailing and other forms of promotion are correlated for opioids?
MR. SOBOL: Objection, asked and answered.
A. Again, the analysis -- the correlation analysis was not possible here, so I'm relying on my past experience and Dr. Perri's expertise.
BY MR. ROTH:
Q. Okay. Then you say: Third, alternative measures of promotion that I could obtain from available sources have substantial missing data, e.g., estimates of payments to pain advocacy groups can only be obtained from the records of some, but not all manufacturers.
Do you see that?
A. Yes.
Q. And that's what we've been talking about.

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A. Yes.
Q. Are you certain that every manufacturer in this case has made payments to pain advocacy groups for opioids?
A. Well, given -- that's -- it's hard to be certain about something for which I have incomplete data, so I -- there are a number of documents that I cite to that show these kinds of payments, and I believe other experts have tracked these payments as well.
But am I certain that every defendant has evidence of that type? No, I'm not certain.
Q. And then you wrap up this paragraph saying: Note that in this case there appears to be substantial evidence that through means other than promotional spending, the defendant manufacturers fundamentally changed opioid prescribing standards. The direct approach does not calculate the efforts -- the effects, sorry -- of the nonpromotional marketing and is thus conservative.
Do you see that?
A. Yes.

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Q. But that's not universally true for all manufacturers, is it?
MR. SOBOL: Objection.
A. Again, my opinions here really are to look at the market as a whole, and even if there were a defendant that did not incur this kind of spending, the effects of changing things like guidelines would -- would flow through to everyone's drugs, right.
So these are sort of broad changes in the environment of prescribing, and so again, I don't have an opinion on the liability question of whether there's a defendant who has not undertaken the unbranded advertising, whether they therefore should not be liable for its effects. I don't know the answer to that.
BY MR. ROTH:
Q. What if a manufacturer engages only in limited detailing and not other types of promotional activities? It would not be conservative for that manufacturer to only look at detailing, correct?
A. The purpose of my analysis is

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not to assign liability to individual defendants. It's to look at the aggregate effect. So I don't know what would be appropriate. That to me seems like a legal question.

Q. Would it be conservative from an economic perspective if a manufacturer purchases an opioid product in, say, 2008 and engages in detailing but no other marketing?

A. I do not calculate any estimates at the individual defendant level, so I cannot characterize them as conservative or otherwise. I'm only looking at aggregate effects.

Q. Okay. I'm just trying to get at what you mean when you say the direct approach is conservative. It strikes me that for a defendant who didn't participate in the market ecosystem until late in the game and only detailed, it's actually the opposite of conservative the way your model calculates damages.

MR. SOBOL: Objection.

A. I believe that is inaccurate. My model does not calculate damages for any

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individual defendant, period.

BY MR. ROTH:

Q. Causation, sorry, I should have said.

A. So again, because I am not looking at impact for an individual defendant, we cannot characterize my analysis as conservative or otherwise for an individual defendant. It is for the market as a whole.

Q. Okay. So when you say in paragraph 56 that the approach is conservative, you mean on an aggregate basis it is conservative because it looks at detailing and not other things?

A. That's correct.

Q. Okay. Sort of implicit in that statement and other things you've said today is an assumption that all manufacturers market opioids the same way.

MR. SOBOL: Objection.

BY MR. ROTH:

Q. Do you agree with that?

A. I don't believe so. Again, I include in my model detailing. To the extent

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that there's variation in the way manufacturers detail, the specific details may generate more prescriptions or fewer, and my model captures the average effect. That's what the coefficients basically tell us is the average effects.

So there may be variation in there, but for the purposes of calculating aggregate impact, the average is appropriate.

Q. So for manufacturers who have detailing that's below average, they're being brought up to the average by the way you've aggregated the model in terms of causation?

A. Well, by definition, an average will be not the same as all the individual components unless there's no variation, and so there will be some who are brought up and some who are brought down.

It's my belief, as we talked about before, that this aggregate model is the most reliable model; because there's substantial spillover effects, because there can be noise in the data when we try to disaggregate it too much. I think for that reason, the aggregate model is preferable.

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Q. You know, though, that not every manufacturer markets products the same way?

A. I guess -- I'm not exactly sure how to answer that question. As we've talked about before, I am not a pharmaceutical marketing expert. I leave that to Dr. Perri. I think it's reasonable to assume that there is some variation in tactics and the like across manufacturers and perhaps across products.

Q. Well, let's look at one thing you do talk about. So there's a difference in the way promotion is engaged in by brand companies and marketing may be engaged in by generic companies, correct?

A. Yes, brand companies are primarily the ones that engage in marketing.

Q. A generic company might still detail but may just talk about price and formulary status?

MR. SOBOL: Objection.

A. Generally, manufacturers will not detail physicians for generics. They may have other sales force activities that they

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do that relate to price, but individual physicians are not generally making a decision about one generic versus the other. That decision happens at the pharmacy.
BY MR. ROTH:
Q. But Attachment C contains a slew of generics on that list?
A. That's correct. Some of them have contacts related to them. Some of them don't. Some of those contacts relate to marketing agreements that are really for brand drugs.
Q. So how do you square your testimony a minute ago that generics generally don't detail with the fact that you have a lot of promotional contacts in your model for generic drugs?
MR. SOBOL: Objection.
A. I believe I just squared it. I think a lot of those contacts relate to marketing agreements.
BY MR. ROTH:
Q. And so if there's marketing under a marketing agreement, that gets attributed to the generic drug, even though

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it may be different in kind than a branded drug promotional visit?
MR. SOBOL: Objection.
A. No. The marketing of a particular drug is identified, and if the drug is sold by a defendant manufacturer, even if it's detailed by a different manufacturer, that gets counted in my model. And then in Table 3, I take out those marketing agreement related drugs.
So -- so it's -- the marketing is associated with -- I mean, I look at aggregate marketing, so it's all in the aggregate marketing. But I do have a mechanism for pulling out marketing that's for someone else's drug.
BY MR. ROTH:
Q. So if that's the mechanism you're using, how are any of these detailing contacts being attributed to generic drugs in your model?
MR. SOBOL: Objection.
A. I think you misunderstand the nature of the model. The model uses aggregate MMEs and aggregate detailing, so

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there's not an attribution underneath that.
And furthermore, as we know, that detailing for the brand drug will spill over to the generic drugs too, and so it's entirely appropriate that the model allows that to happen.
Q. So maybe we're talking past each other.
I understand the model works that way.
A. Yeah.
Q. What I'm talking about, which we'll get to later, is your Table 3 allocates drugs to specific manufacturers, including generic manufacturers, and I'm just trying to understand how that works in a world where we agree that generic drugs generally aren't detailed.
A. So Table 3, it sits on top of a somewhat more complicated analysis, but what it in effect does is it takes the detailing associated with each of those defendants and treats it separately, depending on where we are in the table.
So, you know, at the top for

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Actavis, to the extent that Actavis has detailing in my data, the row that says, well, what would the damages look like or what would impact look like if Actavis' detailing was deemed to be lawful? Basically we've taken out their detailing, out of -- we've left it in basically in a but-for world. It happens because it's lawful.
So that's how -- that's how the allocation works, is in Table 3, it's by manufacturer.
Q. Okay. We'll get there.
A. Okay.
Q. But that's helpful.
If you look back at paragraph 55, I mean, you acknowledge that detailing is undertaken by the brand name drugs in the class, typically peaks during initial launch, and ceases shortly before or after the AB-rated bioequivalent generic drugs enter.
A. That's correct.
Q. And how does your model account for detailing at different points of a product's life cycle, close-to-launch

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detailing versus the period right before generic entry?
A. My model is an aggregate model, so I'm looking across drugs in the entire market, and those drugs are at different stages in their life cycle. And so the important input to my model is the level of detailing, not where it is in the course of a product's life cycle.
But we know that the bolus of detailing happens for these new products, and so that is incorporated into the data.
Q. So it's incorporated in the sense that you'll see more contact at the beginning of the life cycle than at the end of the life cycle?
A. That's correct.
Q. But the detailing that happens at the beginning of the life cycle could be qualitatively different than the detailing that happens at the end of the branded life cycle.
Would you agree with that?
MR. SOBOL: Objection.
A. I don't know that to be true.

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BY MR. ROTH:
Q. As an economist, I mean, when a product is launched, you would expect more detailing about clinical studies and things designed to promote a new product that physicians might be unaware of, right?
A. It may be that there is more of that sort of baseline information at the beginning.
Q. Right. And at the end of a product's life cycle, when the generics are about to come on the market, you might expect the detailing to focus more on things like price and availability and formulary status and things of that nature, right?
A. I have seen no detailing information that pertains to price. I can't say that it never happens, but I've certainly never seen that.
What that sort of -- what you've just described here is on the one hand saying, hey, there's this new drug early on, and don't forgot your old friend at the end, something to that effect. Those -- those differences are not relevant to the question

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of does the detail generate more MMEs.
So for my purposes, I really only want to understand does the detail generate more MMEs. And again, because I'm looking at the aggregate, the fact that some drugs are ending and others are beginning, that -- that sort of -- that mix, it may change a little bit over time, but I'll be looking across a set of drugs at different stages.
Q. Okay. But what I described might be relevant to the question of whether the detailing was lawful, correct?
A. I don't know what you mean by that.
Q. Right. So we've established this, I think, but just to try it one more time: Because your model is just focusing on whether detailing impacts the aggregate number of MMEs, you don't evaluate any qualitative difference in the kind of detailing that is occurring?
MR. SOBOL: Objection, asked and answered.
///

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BY MR. ROTH:
Q. Is that a fair statement?
MR. SOBOL: Asked and answered.
A. I -- you had a "because" at the beginning of that sentence, which doesn't make sense to me. I am not looking at the content of the detailing as we talked about this morning. I am assuming the plaintiffs will prove their case.
I understand that you think differently and you're trying to probe whether I've tried to disaggregate the detailing.
I have not tried to disaggregate the detailing by drug or over time. It is possible to do that, but I have not done that.
BY MR. ROTH:
Q. So in your direct model, just like all MMEs are created equal, all detailing contacts are created equal?
MR. SOBOL: Objection.
A. Again, I would acknowledge that there's variation in detailing and that my model captures the average effect.

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BY MR. ROTH:
Q. And it captures the average effect by treating each contact the same?
MR. SOBOL: Objection.
A. Well, I guess sort of an average effect means that sort of tautologically, I'm summing up all of the effects.
BY MR. ROTH:
Q. Does your model account for rivalrous marketing?
A. I'm so happy that we've gotten back to this.
MR. SOBOL: That makes one of us.
A. The aggregate model that I put forth is intended to essentially obscure the rivalrous marketing, so to the extent that marketing only moves people from hydrocodone to oxycodone or the other direction, whatever it is, that will show up as a noneffect in my model.
So I'm only looking at market expansion because the question I care about is market expansion.

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BY MR. ROTH:
Q. I'm not sure I followed your answer. So how does it show up as a noneffect if you're including that contact in your regression analysis, whether it was new drug promotion or rivalrous marketing?
A. I think the way you're looking at rivalrous marketing is a bit different than the way I would look at it. And this goes back to a conversation we had before where I think there was a little bit of a disconnect.
So it may well be that you go to the detail and what you want to talk about is why you're better than the other guy. But still, what happens is you actually increase the use of any product in this class.
So what I'm concerned about is not the intent of the marketing but the effect of the marketing. You seem focused on the intent.
Q. I do. But now I think you've helped me, and your answer is actually the opposite of what I understood it to be before.

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When you say that rivalrous marketing is a noneffect, what you mean is you don't assess whether the marketing was rivalrous or not, because in either case, your view is it will potentially lead to increased MMEs, so it gets counted?
MR. SOBOL: Objection, form, asked and answered.
A. I am interested only in a particular kind of impact, and that impact is an increase in the number of MMEs. If there is marketing that changes the drug people take without affecting their MMEs, then I ignore that.
Let's just say there's unlawful conduct and you earn money off of it, but it's really only because you've switched brands. That, I'm not counting, so that's a kind of rivalrous marketing effect that's not being counted in my impact assessment.
I'm only concerned about market expansion by definition. Economists can be interested in both of those things, but for my purpose, I'm only interested in market expansion.

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BY MR. ROTH:
Q. I'm just trying to understand functionally how that happens.
So the reason you're saying that is because you're only looking at the delta, the change in MMEs, and so if there's no change, then the rivalrous marketing doesn't get counted? I'm just struggling with the mechanics.
A. Sure. Let me try to explain.
If we had two drugs in the market and we looked at their marketing separately, we could ascertain whether your marketing increases your sales, right, and -- and then what we wouldn't know is, is that increase coming from new patients, or is it coming from the decrease in someone else's sales. So we could use a system kind of analysis to show what's happening.
So people have done this in prescription drugs. I know you've spent some time with the literature, and they're curious about when you increase your sales, does it come at someone else's expense or are you just growing the market. And in different

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drug classes, those two things seem to operate differently.

But if you were to add those two drugs together and say, okay, for any herpes treatment, what's the total effect of marketing? Then what you would get is only the market expansion effect. You would wash out any of the market stealing because your gain is my loss. And so those two things would net out and you'd only get the net result. So that's what I'm doing here.

Q. So the mechanics are because it's an aggregate model that's aggregating all contacts and aggregating all scripts, it comes out in the wash if it's rivalrous?

A. Exactly. Rivalrous, again, my definition of rivalrous is my sales come from you and that those two things fully offset.

Q. Okay. But the detail itself is still counted in the model, because you're not actually looking substantively at the detail to determine what happened?

MR. SOBOL: Objection.

A. That is correct. The detail is still in the model, and where the rivalrous

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piece shows up is that it dampens the effectiveness of marketing that we measure.

BY MR. ROTH:

Q. Okay. We're finally on the same page then.

How does your model account for unbranded marketing?

A. Well, in two ways. In Model C, I explicitly put in some of those events. We can look at exactly which ones they are.

Q. I was saving this for later, but we can --

A. I know, it sounds like an after-lunch conversation, but the consensus statement from the American Academy of Pain Management and the American Pain Society, the Federation of State Medical Boards Guidelines, the JCAHO pain standards released.

So these, I understand that plaintiffs intend to prove they were manipulated by the defendants. So I put those explicitly in Model C.

And then as I describe Model B and my rationale and the way I interpret the

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turning points is that they -- that is incorporating these many different events and tactics.

Q. So the unbranded marketing is captured by the way you do the breaks and the way you test for these five events in Model C, correct?

A. That's correct.

Q. But the unbranded marketing is not captured in the detailing contacts you use for your stock of promotion?

A. That's correct.

Q. How does your model account for the peer-to-peer marketing that I think you or Dr. Perri describes as a contagion phenomenon in paragraph 25?

A. Yeah. So that phenomenon will get picked up in marketing effectiveness, because again, we're looking at aggregate prescribing and not just the prescribing of the targeted physicians.

So, you know, as -- we can go back to our favorite paper by Datta and Dave, they're looking at individual physicians.

It could well be, of course,

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detailing physician A causes physician B's prescribing to increase; they're not really looking at that because they're only looking within physician. But we, for the same reasons that I can capture market expansion appropriately, aggregating up across doctors here allows me to capture that contagion effect.

Q. We do agree, though, that at an individual prescriber, individual detail visit level, there could be variation in the impact that visit has?

A. There may be variation in the impact of detailing on an individual prescriber and her network and my model will average that, will generate a result that captures the average.

Q. And we talked a little bit earlier about some of the variability in the way detailing occurs. I think I used the pizza example.

Do you remember that?

A. I remember pizza.

Q. Okay. I want to come back to that for a minute maybe because it's

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lunchtime.
Not every detail visit occurs the same way in terms of time spent and what is disseminated from the pharmaceutical sales representative to the doctor, correct?
MR. SOBOL: Objection, asked and answered.
A. I would not disagree that details can be different day of the week, whether there's food involved, how much time.
BY MR. ROTH:
Q. And frankly, who is detailed, because it could be a prescribing doctor or it could be a nurse practitioner, it could be some other healthcare professional in the doctor's office, right?
A. Yes, that's correct.
Q. And does the IQVIA data you've looked at distinguish between the target of the detail?
A. It distinguishes between office-based and hospital-based physicians, but it does not distinguish by licensure as you've just described.
And again, what I'm interested

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in is the aggregate impact, and therefore, the average across that variation is appropriately subsumed in my analysis.
Q. Right. And because you used the average, whether the sales rep makes contact with the prescribing doctor and spends 15 minutes discussing the virtues of opioids or whether the sales rep quickly speaks to a nurse practitioner to leave the coffee mug will get treated the same as an average in your model?
A. Yes. And that is appropriate if you're interested in the aggregate effect. If I were interested in comparing the difference between a detail with pizza versus a detail without pizza, then I would want to look at them. But I'm only interested in the aggregate effect.
Q. Are you aware that detailing could be limited to simply providing literature that contains information contained in the package insert or approved by the FDA in promotional materials?
MR. SOBOL: Objection.
A. I'm not exactly sure what you

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mean by simply. I think we're getting into a question about what and how will be proven to be unlawful. And if the question is was certain information omitted, then the fact that the information that was provided was in some way not challenged, to me, seems like it could still be a problem.
But the larger issue is that I think it's not appropriate to try to pull these detail visits off one at a time. If there was some messaging around the utility of treating patients with opioids at an earlier visit and these later visits are just reminder visits, again, I'm not -- I'm not trying to prove liability here, but to me as an economist, it seems like they could well be connected.
BY MR. ROTH:
Q. And they all count the same way as the average?
A. All -- all details in my data are included in the right-hand side, and they produce an average effect, and then I back out those particular ones deemed unlawful.
Q. And similarly, if the detail is

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corrective messaging designed to dampen the effects of some prior materials that FDA has issued a warning letter on, those detail visits get picked up by your data as well?
MR. SOBOL: Objection.
A. I think you need to understand what the regression is doing. It is not just saying sales are strictly promotional to detailing. It's trying to look at that effect, and, in fact, in the last period of my three-period model, the effective promotion is declining.
To the extent that there's corrective messaging, that may be one of the factors that is decreasing the effectiveness of promotion, and so there are not MMEs assigned to have been produced by that detail.
BY MR. ROTH:
Q. Let me just ask a simpler question: Yes or no, are details that are simply designed to provide corrective messaging included in your stock of promotion?
MR. SOBOL: Objection, asked

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and answered.
A. I really have no idea about whether such details exist. My model includes all detailing over the period from 1995 to 2018 based on the instruction that I was given to consider that unlawful.
BY MR. ROTH:
Q. Okay. Without distinguishing between the quality or extent of those detailing visits?
MR. SOBOL: Objection, asked and answered.
A. I do not distinguish among those details, no.
BY MR. ROTH:
Q. And I think we talked about this, but I'm not sure.
You don't differentiate between which physician practice groups were targeted by the details in your model?
MR. SOBOL: Objection, asked and answered.
A. As I noted, my detailing measure is national. It's aggregate. It does not distinguish at a level below that.

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BY MR. ROTH:
Q. Do you have any view as to whether allegedly deceptive marketing is more impactful than truthful marketing?
A. I think I do discuss this in my report, and there's an economic theory related to the profitability of fraud and some evidence from other sectors that suggest that for something unlawful to be undertaken when lawful activities are possible, that it must be more profitable because there's some cost associated with matters such as this one. And so that would suggest that that kind of marketing must be more profitable than marketing to other physicians.
I think this is -- it depends on what assumptions we're making about the intention and knowledge of the various actors. So I think it could go either way.
Q. But within your model, within the time periods of your model, you treat each of the details equally because in your view, you assume them all to be equally unlawful at this point in time?
MR. SOBOL: Objection.

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A. I am, as we've noted earlier, operating on the assumption that the defendants' conduct during the relevant period was unlawful, and my model uses a single measure of detailing and therefore averages across allegedly lawful and unlawful details.
BY MR. ROTH:
Q. Let's look back at Datta and Dave because you asked to.
A. Okay.
Q. It's Exhibit 5, for the record, and I -- can you turn with me to page 454.
A. Okay.
Q. So at the top of the page it says: Thus, detailing plays a role in educating providers about newer drugs and their attributes and may have information value early in a product's life cycle, whereas later in the life cycle, its role can be predominantly persuasive and chiefly relegated to delivering samples and reminders.
Do you see that?
A. I do.

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Q. And then at the end of the paragraph, they say: Because detailing can affect both selective (brand centric) and primary (market) demand under these views -- citation to Dave and Kelly, 2014 -- the question cannot be resolved based on theory alone, and empirical evidence needs to bear upon the question.
Do you see that?
A. Yes. Just to be clear, what they're talking about there is the welfare effects of marketing, and that is a separate question than the one that we're discussing here.
Q. It's the same issue that we've been going around on, right? You're not looking at the welfare, you're not looking at the quality; you're just looking to see if there's a correlation between detailing visits as a stock of promotion against MMEs --
MR. SOBOL: Objection, asked and answered.
BY MR. ROTH:
Q. -- on an aggregate basis.

MR. SOBOL: And there's a lot in there, so be careful.

A. I just want to say that the sentence that you just said had a number of pieces that I think are entirely unrelated to one another.

So a welfare analysis is -- is an economic analysis that is based on the theory of demand and is -- is specific to this idea that consumers make rational decisions, so what he's talking about in this sentence really has nothing to do with this question about the quality of detailing or not.

That sentence is not connected to the "thus detailing plays a role in educating providers." They have a marketing theory that you related before about what happens early versus late in the life cycle, but this last sentence is really just about are consumers better off because of promotion, or not.

And the way economists do a welfare analysis like this one is to assume that consumers are perfectly informed and

perfectly rational and that if marketing is only about stealing market share and it doesn't increase the size of the market, that consumers are worse off. But if it does increase the size of the market, that consumers are better off.

As a health economist and a person who sits in the School of Public Health, I would like to say that if this marketing was only about market expansion, as it seems to have been quite a bit about market expansion, I don't think consumers are better off as a result. They're just operating from a totally different framework.

BY MR. ROTH:

Q. Okay. Let's go back to the first sentence, which I think was more relevant.

They theorized that based on their results, there is a difference between marketing early in the life cycle and marketing later in the life cycle?

A. They are positing a theory about the intent of marketing and the focus of marketing, but they do not say anything

about whether that generates more sales at the beginning or more sales at the end.

There again, they're really focused on this are you getting a new unit from a patient who hasn't been treated versus a new unit from a rival.

Q. Got it.

MR. ROTH: I think now is a decent time to take lunch.

THE WITNESS: Okay.

THE VIDEOGRAPHER: The time is 12:09 p.m. We're now off the record.

(Recess taken, 12:09 p.m. to 12:51 p.m.)

THE VIDEOGRAPHER: The time is 12:51 p.m. We're back on the record.

BY MR. ROTH:

Q. Professor Rosenthal, before lunch we were talking about how your stock of promotion just includes detailing visits multiplied by a coefficient as a single variable; is that correct?

A. Just to be perfectly clear, it's a cumulative sum of detailing in one period -- all the preceding periods with the

depreciation rate applied.

Q. Are you aware that there are other economic studies of the effect of marketing that model detailing using multiple variables?

A. I know that detailing has been modeled as both a stock and a flow, and both at the same time. I don't know if that's to what you're referring.

Q. It may be.

(Whereupon, Deposition Exhibit Rosenthal-7, 2002 Azoulay Publication, was marked for identification.)

BY MR. ROTH:

Q. So let me mark as Exhibit 7 the Azoulay study, Do Pharmaceutical Sales Respond to Scientific Evidence.

Do you have that in front of you?

A. I do.

Q. And the Azoulay study is a document that I think you quote from and -- in your report and rely on in your attachment.

A. That's correct.

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Q. So if you'd turn with me to page 558, and if you have to look before or after to answer this question, feel free, but did Azoulay run a time series regression in this study similar to yours in this case?
MR. SOBOL: Objection to the form.
A. Yes. I should look just to be sure. He's effectively doing a panel model, so he has multiple antacid drugs, and looking at them over time, so I would call it a panel model as we discussed this morning.
BY MR. ROTH:
Q. Okay. And if you look at page 558, there's a description of his variables. And it looks like in his description he has three variables related to the flow of detailing and then also a stock of detailing variable.
Do you see that?
A. Yes, I do.
Q. And then he actually also models the flow of journal advertising and a stock of journal advertising.
A. Yes, that's correct.

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Q. And in the flow of detailing variables, he has variables both for the flow of monthly detailing minutes for a drug and the flow of monthly detailing minutes for competitors of the drug, and then a third variable for the flow of monthly detailing minutes for the firm selecting the drug.
Do you see that?
A. Yes.
Q. So he's, it looks like, measuring the time and length of details in his model?
A. Yes, that -- excuse me. That is what it appears he's doing, and I would note, of course, the purpose of his model is different. We talked about the fact that he's doing a panel data model, so of course he has own and other detailing. That's -- the second detailing is for competitors.
Q. Well, the purpose of his model is to determine whether doctors respond to scientific evidence; is that right?
A. That's one of his purposes. That's the title of his -- of his paper, but he's -- he's looking at detailing and scientific evidence at the same time in this model.
Q. And he's trying to see how doctors respond to both sources, detailing as well as clinical studies and scientific articles?
A. Yes. I'm just saying that because he's using a product-level model and he's interested in how drugs are competing with one another, he naturally includes different variables.
Q. And that's not something you've done in this case?
MR. SOBOL: Objection.
A. That was not my question of interest, and therefore, I've selected a model that is appropriate to the question that I was assigned, which is what is the aggregate impact of marketing of opioids.
BY MR. ROTH:
Q. Okay. And then I'm going to mark as Exhibit 8 a study by Dr. Ernst Berndt and others, Information, Marketing and Pricing in the U.S. Antiulcer Drug Market.
(Whereupon, Deposition Exhibit

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Rosenthal-8, 2001 Berndt et al Publication, was marked for identification.)
BY MR. ROTH:
Q. Do you have the Berndt study?
A. I do.
Q. And if you look at page 102 --
A. Sorry. Oh, there it is. I couldn't find the page numbers for a moment.
Yes, go ahead.
Q. It looks like Professor Berndt and his colleagues are also doing an econometric regression to look at the impact of marketing for drugs in this study; is that correct?
A. Yes. Again, they have a panel model for the same drugs. I believe, actually, they're the same data. Ultimately, I know that Dr. Berndt worked with Dr. Azoulay.
Q. On page 102, in the first column towards the bottom, it says: In terms of marketing efforts, we distinguish three channels: the minutes of detailing to physicians, the number of pages of medical

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journal advertising, and the target rating points of direct-to-consumer advertising.

Do you see that?

A. Yes, I do.

Q. So in this study as well, they were looking at variables to measure the magnitude of marketing, whether by minutes or by pages or by rating points.

A. Yes, they used a different measurement.

Q. Okay. If you turn to page 51 of your report -- I'm sorry, paragraph 51 of your report. It's the section Data Source and Trends, if that helps, on page 34.

A. Yeah, got it. Sorry, I just need to move the clip. Okay.

Q. So you're describing the data you used, and you say: The primary data I used for the direct analysis come from the data tracking and consulting firm IQVIA.

Do you see that?

A. I do.

Q. And then you describe the data: IQVIA maintains a number of data streams that capture information on sales, promotion and

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other statistics by individual drug over time.

And then you say that specifically, the specific products you incorporate are the National Prescription Audit and the Integrated Promotional Service's data.

Do you see that?

A. Yes.

Q. So the NPA and IPS.

Does IQVIA have other marketing or sales data than the NPA or IPS that you could have used in your models?

MR. SOBOL: Objection.

A. Well, the National Prescription Audit data, those are sales data. Those are retail sales, so I just wanted to be clear those are not the promotional data.

The promotional data are the IPS data. And I believe the IPS data, which as we discussed earlier today, do traditionally include samples, journal advertising and direct-to-consumer advertising. I believe that that is their main product. I can't be sure that they

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don't have another promotional product. I'm not aware of one.

BY MR. ROTH:

Q. And as I think we talked about earlier, the IPS data is survey based?

A. That's correct.

Q. And I think you said you didn't run models with samples or journal spend data given gaps in the data?

A. Because there were big gaps in the data, yes, I did not.

Q. Have you used those data sources in other cases where you had more robust data?

A. Yes, I have.

Q. Including in the Neurontin case, I think?

A. We included professional journal articles because there were -- there were monthly data available in those.

Q. Are you aware of any other sources of data regarding prescriber-specific promotion?

A. I am not specifically, but it depends a little bit on what you mean. As

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you perhaps know, the federal government has required that pharmaceutical manufacturers report certain transfers of value at the physician level, and those are publicly available, I think, starting 2014. I may have the year wrong.

So for some years, for some types of activities that are clearly marketing, there are some physician-level data, and I describe some of the papers that use those.

Q. And that's not a dataset you considered using in this case because it started late or --

A. It starts very late, yes.

Q. Okay. Have you heard of something called the Scott-Levin Personal Selling Audit?

A. Yes, Scott-Levin doesn't exist anymore. It's part of IQVIA.

Q. And what years does that audit data cover?

A. I don't believe it's possible to obtain those data anymore since IQVIA purchased Scott-Levin, which must be at least

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five years ago.
Q. So you can't even get old data from Scott-Levin? IQVIA won't allow purchase?
A. I don't recall all the details, but I do recall -- IMS and Scott-Levin had these competing products, and at different times I've used Scott-Levin data and there were some differences. And at one time I tried to get the Scott-Levin data because I preferred it for whatever the project was. I don't recall what the difference was, but I know that I did actually try to get the Scott-Levin data and was unable to.
Q. Did you consider any other sources of prescriber-specific promotion data beyond IQVIA or maybe Scott-Levin for this case?
A. Well, in general, as I noted earlier, I and my staff asked counsel to identify any materials in discovery that would help us with physician-level detailing, and we did not find anything that was comprehensive that we could use.
Q. And when you asked counsel to

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help you identify that data, did you receive like the full suite of data produced in the case? Like what specifically did you get that you looked through to find data that was usable?
A. My staff had access to everything that was produced in the case, and as you know, it's a rather large, complex case, so we made those requests through counsel for help navigating. And I believe that everyone looked to their best ability to find the data that I had asked for.
Q. And when you say your staff, you're referring to Greylock McKinnon?
A. Excuse me. Yes. Greylock McKinnon.
Q. Did you work with Compass Lexecon at all on your report or your models?
A. I attended meetings with them and conversations. I wouldn't say I worked with them directly.
Q. So you had the Greylock McKinnon team working under you, and that was separate from Professor Cutler and Gruber and McGuire's Compass Lexecon team?

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A. That's correct.
Q. Do you know whether your teams interacted with each other?
A. Yes, they did.
Q. Do you know how frequently?
A. I do not.
Q. And I think we talked about this earlier, but let me just ask you an open-ended question.
What data did you review that was -- sorry, strike that.
Did you review any data produced by the manufacturers that was prescriber-specific promotion data?
A. I can't recall whether I actually reviewed prescriber-specific data. I requested it, and what I requested was determined not to be available. I'm not sure if I saw any pieces of data.
I did see marketing documents and product P&Ls that referred to marketing expenditures specifically, but that's not really what you're asking about.
Q. And when you say the data was determined not to be available, was that a

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determination you made or that someone at Greylock made?
A. Well, again, I made a very specific request for detailing data, promotional data over time and across physicians, and I was told that it didn't exist.
Q. But you did have access to some of the marketing budgets which are cited in your report I think in footnote 70?
A. I could check that, but, yes, I did. As I mentioned, I did review marketing reports and product and loss -- profit and loss statements by product.
Q. And did you ask for a comprehensive set of all of the marketing budgets produced in the case?
A. I did, and I don't believe I used them systematically like that, but I did ask for marketing budgets for all of the defendants.
Q. Did you consider using the marketing budgets to measure marketing by dollars spent as opposed to through the IQVIA data?

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A. Yes. And as you know, because there's some missing data for OxyContin, I do actually use the marketing budgets to help me interpolate. But it's not a -- I can't -- it's not monthly data, and -- and I don't have complete marketing budgets for every product for every time period, so it's simply impractical to use that as an alternative.
Q. Did you review prescriber-level prescription data?
A. No, I did not have any prescriber-level prescription data.
Q. Did you ask for that?
A. Because the rate-limiting step is the promotional data, I'm not sure I asked for it. I asked for the promotional side.
Q. But for the other side of your model, the MMEs, you could have ostensibly used prescription data for that, right?
MR. SOBOL: Objection.
A. That would not make sense to have an aggregate independent variable and a disaggregated dependent variable. It would have -- it would have given nonsensical results.

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BY MR. ROTH:
Q. Got it.
So when you say the rate-limiting side --
A. Yes.
Q. -- you only had aggregate data on the promotion side, so you wanted to use aggregate data for everything?
A. Yes. As I mentioned earlier, I considered whether it was possible to take this approach, and I knew that the problem was in quantifying promotion at the individual physician level.
Q. Did you have access to data about payments to key opinion leaders?
A. Again, I believe that some of those payments are tracked in the marketing documents that I looked at. Right now I can mostly think of the ones that go to organizations rather than individual key opinion leaders. I believe some of the other experts examined some of those payments, but I did not directly.
Q. And you anticipated my next question. So you've also seen data about

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payments to pain advocacy organizations, it sounds like?
A. Yes. And again, I think I cite a few examples of those. But if you can't track something systematically over time, you can't include it in a statistical model like this one.
Q. So if I understand your testimony, you did not have access to promotion data that was disaggregated by drug manufacturer and geography?
MR. SOBOL: Objection.
A. I don't think that's -- well, it's not wrong, but it's not right either.
BY MR. ROTH:
Q. It's too broad.
You did not have, on a global basis for all manufacturers, disaggregated promotion data by drug and geography?
MR. SOBOL: Objection.
A. My data allow me to disaggregate by drug, by defendant. And as we talked about earlier, the IQVIA data make it possible to disaggregate by specialty.
I cannot disaggregate by

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geography or by physician.
BY MR. ROTH:
Q. Why did you believe it was appropriate to use a national model?
A. Again, the question at hand is an aggregate question. The question is to what extent did the conduct of these defendants affect the expansion of the use of opioids in the United States and in the specific bellwether counties.
And ultimately, marketing is a national phenomenon. I believe the most reliable way to estimate the effect of marketing on sales is to do so at the national level. It smooths out variability in the data in ways that make the analysis more likely to show a true effect.
It also overcomes certain data challenges that we've been talking about where if we only focused on those physicians who were detailed versus those who were not, we might get the wrong results.
So in sum, the aggregate analysis in my mind is the most reliable way to estimate the impact of the alleged

misconduct.
Q. If you did not use aggregated national data, would there be more variability in the data that make it more likely there would not be a true effect shown from promotion?
MR. SOBOL: Objection.
A. Anytime we disaggregate data, we will increase the amount of variability, and that creates statistical noise which can essentially overwhelm the effects.
BY MR. ROTH:
Q. Did you test your hypothesis that marketing is national in scope by comparing the impact of detailing stock across geographies?
MR. SOBOL: Objection.
A. It's -- I began the analysis on the premise that this was a national campaign of misinformation, allegedly, and so an aggregate model is the right place to begin.
To the extent that there's geographic variation, it would nonetheless be true that the aggregate effect would capture all of that variation.

In all of the instances where we have talked about variation today, that variation is appropriately subsumed in my model. I do show an average effect, but that is what is meaningful for constructing aggregate impact.
BY MR. ROTH:
Q. Do you have any opinion as to what is causing the geographic disparity in the number of opioid shipments, given your view that the marketing campaign was national in scope?
MR. SOBOL: Objection, scope.
A. The geographic variation in opiate prescribing and deaths is really the subject of Professor Cutler's report. I do not have an independent opinion on that question.
BY MR. ROTH:
Q. But you are aware from studies and data that the opioid issues affect certain geographies of this county more than others?
A. Yes, and I believe Professor Cutler addresses that directly in his report.

Q. That's not an issue that you've studied or have an opinion on?
A. That's correct.
Q. If you look at paragraph 61, we've finally gotten to your equation. And can you just confirm, I don't believe this was changed by your errata, although I saw some equations did change so --
MR. SOBOL: That's my copy. I'm kidding. Actually, I think it is.
A. Just checking, myself. I think it's in the appendix that the equations were changed, yeah. They're all in Attachment D, yeah.
BY MR. ROTH:
Q. So this equation on page 43, Qt equals --
A. Checking your Greek.
Q. -- alpha -- no epsilon?
A. That's alpha.
Q. Alpha. I thought it was. Qt equals alpha plus -- why don't you just say it in words, because if I try, I'm going to massively fumble it.
A. We could say it in actual

words. So Q is the quantity of opioid MMEs for a particular month. Alpha is just the constant term. That's just the intercept. S prime of t is -- this is the -- in this case, it is the stock of detailing. Beta is the coefficient on that, just using the standard for doing matrix algebra in reverse.
So -- and then X is the vector of other factors. So in Model C, right, it includes those dummy variables in addition to price. And then e is the error term. And gamma, sorry, is the coefficient on those X variables.
Q. And in terms of the other factors variable, the only things being picked up there are price and then the Model C events?
A. That's correct.
Q. And essentially what this equation allows you to do is plot total opioid MMEs over time against your stock of detailing over time?
A. I guess I don't know what you mean by "plot." This equation is intended to represent the regression line that is being

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determined by the statistics, which essentially looks at the variance and covariance of the underlying valuable -- variables to ascertain what that relationship would be to calculate the alpha, beta, gamma.

So I guess plot is one way of thinking about it, but it's in multidimensional space, so...

Q. My mathematical mind is more limited than yours --

A. Okay.

Q. -- so I used the term "plot." I apologize if that's too narrow.

A. That's okay.

Q. What is a stock of detailing?

A. Well, stock of detailing is like a stock of anything else, that it's cumulative and it has a depreciation rate so that we can ascertain how the cumulative effects relate to things that happened in the distant past versus the near past.

Q. And why did you decide to use a stock instead of just the number of contacts?

A. The stock of detailing -- I know you've gone over a couple of papers, but

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if you look across the literature, probably about half of them use the stock of promotion.

It's conceptually appealing because the idea that you don't just forgot something because you were detailed two months ago, that makes sense, that detailing in one period would have effects in a later period. So that's the main reason for doing it.

Q. It's true, then, that your stock of promotion is a calculated value in your model; it's not some observable number out there in the world?

A. I'm not 100% sure what you mean by that, but -- so the stock is -- it's observable by adding up things that are observable.

The depreciation rate is estimated in the context of the model using a specification test, so that part, you know, again, it comes from the underlying data, but it is estimated.

Q. Okay. And then in paragraph 62, you say: Detailing contacts

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were entered into the model as a stock, including the number of current contacts and the depreciated value of past contacts.

Do you see that?

A. Yes.

Q. And what does the word "depreciated" mean to you?

A. Depreciated in this context is multiplied by one minus the depreciation rate, which I know we're getting to this. In some cases it inflates the stock, and in some cases -- well, it doesn't inflate the stock per se, but it inflates past promotion versus deflates it, yes.

Q. In general, though, depreciation means reduce or diminish the effect, right?

MR. SOBOL: Objection.

A. I think if you look it up in the dictionary, it would do that, but we think about negative interest rates even though we think about interest rate just literally being something that increases the value of your asset, we can have negative and positive interest rates by the same token.

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BY MR. ROTH:

Q. Your coefficient on the stock of detailing actually assumes the effect of detailing increases over time?

MR. SOBOL: Objection.

A. I don't know what you mean by -- when you say assumes, because it's empirically estimated, but, yes, it is consistent with the idea that past promotion increases in effect over time.

BY MR. ROTH:

Q. So as time goes on from that detail visit, the impact just gets stronger and stronger in your model?

MR. SOBOL: Objection.

A. As you know, my model is estimating the relationship between promotion and sales for an addictive good, and so what we're saying is let's say promotion caused them -- the physician to write a hundred MMEs in a prescription today, as the patient gets more tolerant, not only do they continue writing that prescription because the patient comes back, but also the dose goes up. So that is really what the negative depreciation

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rate is about here.
BY MR. ROTH:
Q. So is your suggestion that the doctors are addicted to writing prescriptions?
MR. SOBOL: Objection.
A. I didn't say that.
BY MR. ROTH:
Q. So when you say it's the addictiveness, your suggestion is because the patient may become addicted, the doctor is going to continually ratchet up the dosage for that patient?
MR. SOBOL: Objection.
A. You make it sound like the opioid epidemic is speculative. It is clearly true that patients who started on a particular dose of opioids get higher and higher doses. That has -- that is just common knowledge, and other experts have opined on that.
And so it is a fact of the matter that some patients will require escalating values in terms of the number of MMEs, whether they're addicted or not, and

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then also it is true that some of those patients will become addicted. I think there's no question in the literature about whether prescribed opioids cause addiction. So that is true.
And the fact of the matter is that I'm not describing physician behavior as addictive; but if those patients come back to their physician and say, "My pain is getting worse, I need another prescription," then in some instances it will be filled.
BY MR. ROTH:
Q. What percentage of patients need escalating doses of opioids?
MR. SOBOL: Objection, scope.
A. I'm not a clinical expert. My analysis is entirely empirical. If this were not happening, my analysis would not find that these MMEs are inflating over time in the way they are.
BY MR. ROTH:
Q. I know you're not a doctor, so I'm just trying to understand, like what -- you say it's common knowledge.
What basis in science or

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literature do you have to opine that the addictiveness of opioids means that doctors are prescribing higher and higher dosages to their patients?
MR. SOBOL: Objection, asked and answered.
A. If you look at Figure 3, this is where I empirically demonstrate what's happening with the strength --
MR. SOBOL: Page?
THE WITNESS: Oh, sorry.
Page 37.
BY MR. ROTH:
Q. Right. That's on an aggregate basis. I asked you a different question. With --
A. No, no, no. I'm sorry, but the aggregate basis means that the average MMEs per prescription is escalating at this very high rate. That means that some large number of patients under it -- for it to increase at this rate, it cannot be that just a handful of patients are getting more.
Q. It could just be, though, that stronger drugs are prescribed. It doesn't

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mean that a specific patient is getting higher and higher doses because of the addictiveness of opioids.
MR. SOBOL: Objection.
A. I do not derive that -- these data really show that higher and higher doses of MM- -- of opioids are being prescribed. I mean, that's just literally what they show. The MMEs per prescription is increasing.
So that is showing that -- whether it's addiction or not, that patients are getting higher and higher doses. That mechanically will have the effect of making it look like past promotion is suddenly more effective today than it was yesterday.
BY MR. ROTH:
Q. And so, in effect, your depreciation rate is an appreciation rate in your model.
MR. SOBOL: Objection.
A. You may use that term. I think it's more standard to call it a depreciation rate. Also, as you know, I estimate multiple models, and they don't all have a negative depreciation rate.

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BY MR. ROTH:
Q. What do your models say about a single detailing visit in January 1995 with regard to its impact today?
MR. SOBOL: Objection.
A. Can you explain what you mean by that?
BY MR. ROTH:
Q. Yeah.
So the way your stock of promotion is calculated, it keeps aggregating. So would a visit in January 1995 still be growing in impact in your model?
A. In the fact -- in the models with the negative depreciation rates, the past promotion continues to grow, yes.
Q. And at what point does it reach its maximum impact?
A. Well, I think you should not try to extend the analysis out of sample. Again, what I show in my model is while on average, because I estimate a single negative depreciation rate, we see this negative depreciation rate, but we also find that the

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effectiveness of promotion is falling.
And so while the stock may be increasing, its effectiveness is decreasing.
Q. Yeah, and we'll get to the other adjustments. I just want to talk about the depreciation rate first.
So under your model, the detailing that happens today is 8.3% more impactful next year than it is today?
MR. SOBOL: Objection.
Objection.
A. For a given quarter, after a year, the appreciation is 8.3%, yes.
BY MR. ROTH:
Q. And after ten years, detailing that happens today would be 223% more impactful than it was today?
A. I think you'd have to give me a calculator, but I'm willing to trust your math.
And just to be clear, it's not exactly impactful because, again, you have to recognize that the coefficient on promotion is changing over this same period, and because that -- that coefficient is dropping,

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we're actually seeing reductions in sales.
Q. You agree that an appreciating depreciation rate is at odds with the usual marketing literature in economics?
MR. SOBOL: Objection.
A. I don't know that it's at odds with the underlying theory of marketing. Because this is an addictive good, I think it's a very different set of circumstances.
Usually we do see depreciation falling, but I would note also that this is a special case, as we've talked about many times today. I'm interested in this entire market and not one drug.
And so usually when the marketing literature is looking at this, they're looking at an individual drug, maybe even an individual physician. And here we're really talking about the growth of an entire set of practices around the use of opioids.
BY MR. ROTH:
Q. You say in your report: A negative depreciation rate indicates that the stock of promotion grows over time.
Correct?

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A. Yes.
Q. And then you say: This prediction may be at odds with the usual marketing literature.
A. Yes. But I want it to be clear, however, that it's not a theoretical, the theory that I've just described, whereby the role of addiction is entirely consistent with a negative depreciation rate.
Q. And in your report, where you say that, you've got a footnote and you cite to Perri's report?
A. Yes.
Q. And you quote him in saying: Additionally, because prescription opioids may result in tolerance, dependence, and/or addiction, the overall demand for opioids is distorted by pharmaceutical marketing aimed at increasing the use of these drugs. I refer to this as a distortion because, whether due to tolerance, dependence, or addiction, some patients who use opioids require and/or seek more opioids over time.
Did I read that correctly?
A. You know, I thought I saw that

correct footnote, and then I was looking at the wrong one.

Q. Sorry. It's page 49, 103.

A. 49.

Yes.

Q. And based on that statement, you believe that a negative depreciation rate, although at odds with the usual marketing literature, is perfectly consistent in this case?

A. Just to be clear, I'm not relying on Dr. Perri for my understanding that opioids are addictive. I'm relying on the broad facts of this case, my knowledge in public health, and that is the reason why I think, while marketing studies that have looked at other goods have not found this, it is entirely theoretically consistent that we would find a negative depreciation rate here.

Q. Have you looked at marketing studies relating to other addictive goods?

A. I don't know of any other marketing studies related to addictive goods.

Q. Tobacco?

A. Yes, I have -- I'm certainly

familiar with the tobacco literature. That literature, as you may know, focuses largely on taxes and the effect of a marketing ban in terms of broadcast advertising.

I don't know that the literature has looked at the stock of promotion at all.

Q. What about marketing literature related to alcohol?

A. I have not seen any of that literature, no.

Q. What about marketing literature related to marijuana?

A. I --

MR. SOBOL: Wait. Is that addictive?

THE WITNESS: Wait, is there marketing? But now, you're right, there may be a market.

I would be interested to know if such literature exists. I'm not familiar with any literature like that.

BY MR. ROTH:

Q. Okay. As you sit here right

now, do you know of any literature, whether related to nonaddictive or addictive products, that has a negative depreciation rate?

A. I cannot point to any other study, no.

Q. Let's look at the Datta and Dave study again. So if you look at page --

A. Sorry, I lost Datta and Dave.

Q. Sorry, it's okay.

A. Yeah. Okay. I got it.

Q. Page 457, footnote 23.

Do you see that?

A. Yes.

Q. So in this study, it says: We chose to rely on the literature for fixed estimates of the depreciation rate rather than estimate it as an unknown parameter.

A. Yes.

Q. And they say: An unbiased estimate of the depreciation rate would require a detailed structural modeling of promotion and prescription behaviors, without which it would be difficult to disentangle the coefficient of the detailing stock from

the depreciation rate.

And there's then a cite to Iizuka and Jin.

Do you see that?

A. I do.

Q. And in what way did you structurally model prescription behaviors in your model?

A. Well, I followed the same practice that Professor Berndt and others have used, which in effect simultaneously estimates the two parameters. It's not, strictly speaking, a structural model. It really requires that we reestimate the model with a whole range of estimates and then see which one has the best fit. It's an alternative approach to the structural modeling approach.

Q. Datta and Dave go on to say: Prior research on consumer behavior suggests that advertising effects fully depreciate within six months to a year, consistent with decay rates of 0.1 to 0.2, which have also been found to apply to pharmaceutical advertising.

Do you see that?
A. I do.
Q. Okay. And then --
A. I would note that Professor Berndt's article that you shared with me earlier finds a depreciation rate of zero, and he concludes there and elsewhere that it's consistent with our understanding that pharmaceutical marketing is long-lived because of the habit formation, so there's clearly some disagreement in the literature about what's the right answer.
Q. Right. But he has no depreciation rate. He doesn't have an appreciation rate in his study.
A. The difference between zero and a small negative is -- they're both kind of getting at the same notion, which is that marketing from many periods ago is still persistent today.
Q. And the Berndt study you're citing predated this Datta and Dave study; is that right?
A. I believe it did, yes. It's an earlier study.

(Whereupon, Deposition Exhibit Rosenthal-9, 2004 Mizik and Jacobson Publication, was marked for identification.)
BY MR. ROTH:
Q. Okay. And now I'm going to show you Exhibit 9, which is the Mizik and Jacobson study, Are Physicians "Easy Marks"? Quantifying the Effects of Detailing and Sampling on New Prescriptions.
Do you have Exhibit 9 in front of you?
A. I do.
Q. And this is another document you relied on and quoted in your report.
A. Yes.
Q. And if you look at page 1710, under the chart, do you see there's a heading Detailing?
A. Under -- in Table 2?
Q. Yes. There's a Detailing heading on the column underneath Table 2.
A. I'm sorry.
Q. Sorry, I'm below Table 2. Left side.

A. Oh, yes. In the text.
Q. In the text.
A. I'm sorry, I was looking in the table for a column heading. Yes. Yes. I'm sorry.
Q. Okay. So in the column heading in the text, it says Detailing, and then it says: For each of the three drugs in the study, we observed statistically significant positive albeit modest effects of detailing on prescriptions.
Do you see that?
A. Yes.
Q. And then it says: Both current term and carryover effects exist. For drug A, statistically significant positive effects are present contemporaneously and for the subsequent four months.
Do you see that?
A. Yes.
Q. And then if you jump to the next column, the bottom paragraph says: The estimated response to a change in PSR visits for drug B is similar to drug A in that we observe a statistically significant response

the month of the visit that diminishes over the subsequent six months.
Do you see that?
A. Yes.
Q. And then you referred already to the Berndt study, which I believe you have there.
A. Yes.
Q. If we look at that at page 104 -- it's Exhibit 8 -- I thought you said the depreciation rate was zero, but looking at page 104 on the second column, it actually looks like it's 0.03.
A. It may be there's another Berndt paper that I believe that I cite. I know there's a zero depreciation rate in one of them. That may be -- if we look at my literature summary, it may be clearer.
Q. Okay. We can do that on the next break, but for now let me just mark Exhibit 10.
A. Okay.
(Whereupon, Deposition Exhibit Rosenthal-10, 2001 G?n?l et al Publication, was marked for

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identification.)
BY MR. ROTH:
Q. Which is the G?n?l study, Promotion of Prescription Drugs and Its Impact on Physicians' Choice and Behavior.
A. I'm sorry, were you going to ask me a question about this study?
MR. SOBOL: Which one?
BY MR. ROTH:
Q. I think I did. I was just asking what the depreciation rate was and you said --
A. I'd just like to remind you, when we talk about these marketing studies, and Mizik and Jacobson is similar to the Datta and Dave one, it's a short period of time for a few select drugs. It doesn't have the ability to look over the long term the way we do.
Q. No, I understand.
And for those drugs, the depreciation happened within months. In your model, the appreciation happens forever.
A. Yes.
Q. So if we look at Exhibit 10,

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the G?n?l study, if you look at page 85, there's a paragraph, Cumulative Discounted Sums of Detailing and Samples.
Do you see that?
A. You're on 85?
Q. 85.
A. Yes.
Q. And in that paragraph it says: For each prescription physicians write, they are likely to be influenced by past personal selling efforts. We discount the cumulative personal selling effort consistently with the methods used in the advertising literature. The major premise of these methods is that physicians are influenced by the recent visits of sales representatives more than by the distant ones.
Do you see that?
A. I do.
Q. And it looks like in this study -- well, maybe you can help me find it. I don't know if it's on this page.
A. They don't -- they don't estimate a depreciation rate. It says they set one.

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Q. Got it.
A. I think it must be in the footnote. Yes.
Q. Yeah. I don't see the exact number. But in any event, they depreciated their stock somehow, and if we took the time to review this, we could probably find the exact number.
So switching gears for a second. So you said you're not aware of any article. Have you ever done any work in your litigation consulting or expert practice where you've modeled a negative depreciation rate before this case?
MR. SOBOL: Objection, asked and answered.
A. I would return to the fact that this matter concerns a class of drugs that is different from any other class of drugs for which I have looked at marketing, and I believe that the negative depreciation rate is entirely consistent with that underlying phenomenon.
I have not worked on opiate addiction in the past. I have not worked on

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a marketing study for an addictive product.
BY MR. ROTH:
Q. Okay. And as you sit here now, you're not aware of any peer-reviewed publication or study that suggests that a negative depreciation rate is ever appropriate?
MR. SOBOL: Objection, asked and answered.
A. It's my belief that a negative depreciation rate is entirely theoretically consistent with this product. I cannot cite a paper that has estimated one, but I do not find it surprising.
BY MR. ROTH:
Q. Okay. Let's look at paragraph 55 of your report and Figure 4 below that. Are you there?
A. I'm sorry, you're at paragraph 55 -- I'm sorry, I went to the next page.
Q. Yeah, and it spills -- sorry, it spills to the next page, which is Figure 4.
A. Yes.

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Q. Are you there?
A. Uh-huh.
Q. And in this chart it looks like you actually model your depreciation rate in red against what your model would look like with no depreciation rate or even a small positive depreciation rate.
A. I show you what that would look like, yes.
Q. So with even a very slight positive depreciation rate, the line looks almost flat.
A. You mean the .01?
Q. Correct.
A. Yes.
Q. And if you hold the depreciation rate at zero, it's got a small increase, but not anywhere close to what you show with your negative depreciation rate?
MR. SOBOL: Objection.
A. But as you've described the lines, the line that represents the depreciation rate I estimated grows more rapidly, as would be expected because of compounding.

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Just to be clear, the fact that the stock of promotion grows in this pattern, that is a question of fitting the model appropriately. It's not driving my results in that same relationship.
BY MR. ROTH:
Q. I'm not sure I understood your last answer. What do you mean it's not driving your results?
A. Well, the results aren't inflated in the same way that the stock of promotion is inflated. The estimate in my model, again, where I have promotional effectiveness coefficients, they're now responding -- they'll be lower than otherwise because the average level of promotion is higher, and so it effectively makes promotion look less effective on an incremental basis.
And this is really a question of just getting the best fit in terms of the timing.
Q. Okay. The blue line on this line graph you describe as the flow of the data. Can you explain what that means?
A. Sure. Those are the monthly

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levels of contacts.
Q. So with no adjustment for a stock, this is just the ebb and flow of where the IQVIA data shows promotion is?
A. Yes, it's the unadjusted IQVIA total detailing contacts.
Q. So it spikes up and down over the course of the entire period?
A. It does have the pattern that you see there.
Q. Okay. Have you run your models with positive depreciation rates other than the 0.01 you depict on Figure 4?
MR. SOBOL: Objection.
A. That's not running the model. That's just showing you what the stock would look like.
BY MR. ROTH:
Q. Okay. So have you even run the model with the stock at 0.01?
A. I have not.
Q. Okay. So you don't know what that would look like, and you don't know what it would look like if we used a higher depreciation rate?

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MR. SOBOL: Objection.
A. I don't.
BY MR. ROTH:
Q. And I think you said this, but your model selects the depreciation rate that produces the best fit?
A. Yes, that's correct. It uses a Wald test.
Q. Okay. We'll come back to the Wald test. But let's look at Figure 2, which, I believe, is a few pages earlier.
A. Page 36?
Q. You got it. So Figure 2 is a line graph of the MMEs over time.
A. That's correct, and it also includes extended units in blue.
Q. And what does that mean, "extended units"?
A. Extended units are pills.
Q. Okay. So you've got both the pills and the MMEs on this graph?
A. Yes, and you can see they track almost perfectly.
Q. And you can tell, I think, the first thing I see when I look at this graph

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is a pretty stark decline that starts in 2010.

Do you see that?

A. It does have a clear peak, both of those trends.

Q. And do you have any understanding as to why MMEs began to drop off starting in 2010?

A. Well, I think I write about that pretty extensively in my report.

Q. In paragraph 46 -- yeah, let's look at paragraph 46.

A. Maybe not 46. Maybe 56?

Q. Oh, you know what, that's Gruber 46. We'll get to him next.

A. I'm sorry. Okay.

Q. Sorry, which paragraph were you taking me to?

A. I am looking for where I discuss the peak.

Q. All of your reports magically have the same font and type space, so it's hard to differentiate.

A. I think it's later when I talk about --

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Q. 67 --

A. -- estimating the breaks.

Q. 67.

A. Yeah?

Q. Yeah. I think I found it.

A. Yes.

Q. Okay.

A. So that's sort of the -- that's where I talk about the first break.

Q. Yeah. So you say: The accelerated growth in opioid prescribing that followed the guideline and messaging changes continued for approximately a decade before it was finally arrested and ultimately reversed by the cumulative effects of physician leadership, media attention, public health surveillance and regulation.

Do you see that?

A. I do.

Q. And you agree that all of those efforts, doctors, media and public health, did not just simultaneously happen in August 2010?

A. They did not, which is why I don't assume that.

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Q. And when you refer to regulation in that paragraph, what specifically are you talking about?

A. Well, so, for example, certain states required that physicians use a database to look at prescribing for the patient before they could write a prescription, so prescription drug monitoring programs and educational requirements around those prescription drug monitoring programs.

In some places there are -- like Massachusetts, for example, there have also been prescribing limits that were passed. So those kinds of things.

Q. And then did you review Professor Gruber's report?

A. I did.

Q. Before yours was finalized or at some point after?

A. Perhaps before.

Q. Okay. So I'll -- I could mark it, but I'm just going to read to you from it. And if you want me to mark it, I will.

But he says in paragraph 46: Beginning around 2010, increased enforcement

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actions by DEA and DOJ, criminal actions and litigation, the growth of state PDMP laws and increased awareness of addiction risks associated with prescription opioids contributed to a reduction in aggregate shipments of prescription opioids after more than 20 years of rapid growth.

Are you aware of that passage in his report?

A. Yes, and I think that there's absolutely nothing inconsistent with what he says. He uses a couple of different examples, but we're in agreement that it's multifactorial and gradual.

Q. Agree. And you both mention PDMP laws, and I think he's got a couple of other examples about the DEA and DOJ.

But that was what I was going to ask you is, are you in agreement with him that these multifactorial events contributed to the decline in 2010?

A. That is the environment that I capture using that third era in which these events are essentially reducing the effectiveness of promotion.

Q. Okay. So let's talk about your eras. So if you go to paragraph 71, you're talking about Model B, and I think you called this in your report your preferred model.

A. I do.

Q. Okay. And just so we differentiate, we'll get to Model C.

Model A, as you describe it in paragraph 70, is assuming the effectiveness of detailing is constant, so meaning, if I look at Table 1, you just used the stock of promotion and the depreciation rate without adjusting for different eras in Model A.

A. Yes, that's correct. I mean, they both have a single depreciation rate, but there's a single stock of promotion in Model A, and the price index, of course.

Q. And then in Model B, it's those two things plus you've added these two eras in?

A. That's correct.

Q. And in Model C, it's Model B with the five events mapped onto it?

A. That's correct.

Q. Okay. So let's start with

Model B. 71 says: Model B allows the effectiveness of promotion to change at two points in time, determined using specification tests. Thus, this model captures three different periods or eras of the opioid market: the initial era, an increase in MME sales during the second era, and a third era marking the gradual decline of MME sales.

Do you see that?

A. Yes.

Q. What do you mean, "determined using specification tests"?

A. Well, we essentially -- we do much the same as what Professor Cutler does in his report, which is basically conduct an F-test, which is looking at the fit of alternative models, and we have these -- we have two time points, so we're looking at a two-dimensional space and looking to see which model fits the data best by, again, iterating over -- I think it says in --

Q. Yeah, let's look at Attachment D5. I'll help you out.

A. That's right, iterating over, I

don't know, 1600 models, something like that.

Q. You get how this goes. I get your memory first, and then we can look at the report.

A. Yes. I know I should just tell you that I don't remember.

Q. That's okay. All right. D5, Determining Turning Points in Effectiveness of Promotion.

A. Okay.

Q. Tell me when you're there.

A. D5. Okay. Yes.

Q. So it says: In Model B, the two dates that would delineate the early and late change in the effectiveness of promotional stock were determined through a two-dimension search. The first turning point was chosen between January 1999 and January 2003, and the second turning point was chosen with the date between January 2010 to December 2011.

Do you see that?

A. Yes.

Q. So let me stop there.

So when you say "it was

determined between," were you just conducting the searches within those date ranges?

A. Yes, that's right.

Q. So you didn't just search the whole model for the breaks; you limited the dimensions you were looking for?

A. Well, as you can see, there were 1,176 combinations already, so there's a bit of a scale issue in looking at every combination.

And also, the way the tests work out, it seemed fairly clear that we weren't getting better and better fit by going out further, that the solutions were closer to the middle, and so that's why we didn't feel like we needed to go outside of those ranges.

Q. How long did it take the computer to run 1,176 combinations?

A. Fortunately, I did not have to run those myself. Probably not that long.

Q. I feel bad for Greylock.

And so you ultimately chose these two breaks based on the maximum Wald statistic produced from running the model

almost 11 -- 1,176 times?
A. That's correct.
Q. And what is a Wald statistic?
A. It's -- like I said, it's like an F-test that's looking at the joint significance. We talk about an F-test elsewhere in this model, looking at the joint significance -- actually, in my errata you see I talk about the F-test, doing significance of a set of variables and seeing the formulation in which those variables explain -- effectively explain the model best.
Q. And is it a common practice in econometrics to choose a model based on maximum fit?
A. It's one of the considerations that one does in a model. And here we're talking about a set of parameters that we're trying to optimize with regard to depreciation. It's not the only thing that we use to select the model.
As you know, I also report the adjusted R-squared, and that was part of my decision-making across models. And there are

other factors.
Q. Okay. If we turn back to the body of the report, paragraph 57 introduces Figure 5.
Do you see that?
A. Uh-huh.
Q. So you say: Figure 5 -- which is on the next page -- is a timeline of key events. According to plaintiffs' experts and the published literature, the perceptions of physicians and the public evolved as a direct result of the alleged misconduct.
Do you see that?
A. Yes.
Q. You cite Dr. Perri.
A. Yes.
Q. And then you say: These changes, which were the result of the defendants' actions, would have affected the receptiveness of prescribers and patients to promotional messages about the safety and effectiveness of opioids.
Do you see that?
A. Yes.
Q. And then you describe how the

key events identified by plaintiffs that helped promote expanded prescribing are in green and the subsequent public health and regulatory events that signaled the growing realization about the dangers are in red.
A. Yes.
Q. All right. So let's look at Figure 5 on page 41, and we're going to do our best job to articulate on the deposition transcript the picture that we're looking at.
So it looks to me like Figure 5 is --
MR. SOBOL: Why don't you show it to the camera for a second. Seriously. Just get a shot of that.
MR. ROTH: It's a work of art.
THE WITNESS: It is a work of art.
MR. SOBOL: Christmas.
BY MR. ROTH:
Q. So if you look at Figure 5, you've got the MME trend graph that we looked at in Figure 4 with a timeline and the events described in the paragraph above it, right?
A. That's correct.

Q. And so we'll talk about the five you picked to test in Model C, but did you think about using any of the events on this timeline to choose where you do your testing for the breaks?
A. I considered and rejected that idea for reasons I think I do describe in my report. And I'm happy to explain further.
Q. Yeah, if you don't mind.
A. So as you can see from the timeline, there are a number of discrete events. They're marked on the timeline at the time they were either announced or passed or in some way published, and still, they are clearly events that could have had both anticipation effects and sort of long adoption curves.
And so just the notion that these -- any one of these points would have determined a break in the promotional effectiveness, it seems like it was not quite the right model. Although, again, I included them in Model C to explore this further.
It's my opinion that these should be treated more cumulatively and that

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is why I used the multi-era model, and I think that's entirely consistent with the way Dr. Perri describes the events, particularly the green ones, the ones that were influencing the adoption of opioids.

Q. Just so I understand it, your break based on the Wald statistic is sometime in early 2002; is that right?

A. It's probably not a good idea ever for me to trust my memory, so I'm going to go and look at that.

Q. Yeah. It's in the report.

A. Yes, it is, it's absolutely in the report.

Q. And it may be in the errata, because I saw some of the dates changed a little bit last night.

A. Paragraph 71.

Q. Paragraph 71, yeah.

A. Right. So March 2002 is the first break.

Q. In the report it says April 2002. That was one of the errata?

A. Yes. I think someone was reading the first month versus the last

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month, the first of the old era versus the last of the -- first of the new era.

Q. So it changes as of April 1st?

A. It changes as of March 1st. I mean, the data are monthly, so -- not daily, so it changes as of March.

Q. Okay.

A. And then the second turning point changes as of August.

Q. So if we were to plot March 2002 on Figure 5, it would be after the first five events in green but before the last two events in green?

A. That -- I can affirm that.

Q. And then if we were to plot the August 2010 break on the curve in Figure 5, it would be -- it looks like after maybe three or four of the red events but before the other six or seven.

A. I -- that may be true. I think it's a lot harder to say. That's just a dense part of the chart, and I wouldn't trust my eyeballs on it.

Q. Okay. But again, as we discussed, those breaks are not correlated

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with these events; they're the function of searching using the Wald statistic for where the curve breaks?

A. Yes. And again, to be clear, they're telling us where the relationship between the stock of detailing and sales seems to change in a statistically significant way. And they're entirely consistent with some kind of S-curve at the beginning, when we think about a standard diffusion curve, that there -- there is sort of a point at which diffusion accelerates, and that is what we're estimating on the first one.

And the second turning point I guess would be a reverse diffusion curve. I think de-innovation is a word, and not one that I use a lot, but that seems to be what's happening. And again, it's not like you've turned on a light switch and everyone changes, but cumulatively over time, that's putting the brakes on.

Q. Okay. But your model, the way you account for that is you do actually turn on the light switch and change the stock of

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promotion as of those dates?

A. I -- no. That's not -- that's not true. So what I do is I allow for the promotional effectiveness to change in the -- in the first instance as a level shift and in the second instance as a trend shift.

Q. And so we'll talk about each of those, but in paragraph 68 you talk about how this led you to adopt a piecewise model. What is a piecewise model?

A. Well, it's essentially where I assume there's a linear relationship between the stock of promotion and sales that differs over these different eras.

Q. And when is it appropriate to use a piecewise model in econometrics?

A. Well, in this case, this is an aggregate time series model, and we believe that the fundamentals of that relationship are changed by something in the environment.

Q. So in addition to your appreciating depreciation rate, we now have adjustments in these two eras to fit the MME curve.

MR. SOBOL: Objection to form.

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A. Just to be clear, it's about fitting -- the R-squared is about fitting the MME curve, but really, the test that we're doing is about understanding the relationship between detailing and sales and fitting that.
BY MR. ROTH:
Q. I understand that, but you're making modifications to the detailing stock that is allowing it to fit better with the MME curve?
A. Well, the detailing stock and -- you're talking about the depreciation rate. That is being determined, again, based on the fit of the overall statistical model. It's not just trying to make it fit the shape of the MMEs, which I think is what you said.
Q. Right. But when you make the depreciation rate change to the stock of promotion and then you allow the model to tell you where the effectiveness of promotion also changes, are you not then essentially fitting the detailing curve to the MME curve?
A. I do not believe so, no. That's not what I'm doing. What I'm trying to do is establish a relationship that best

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fits the data. Over time, that relationship could be that promotion has very little effect on sales. And so the quantum of the impact here is not what I'm fitting the data to.
Q. Okay. As you describe it in your report, the coefficients on the stock of detailing are estimated separately during each of the three eras; is that correct?
A. Well, in effect, we can look at the results, so maybe it will be a little clearer than my hand-waving without having it in front of me.
Q. Table 1, is that what you wanted or do you want --
A. Yes, Table 1, that's right. So we have the stock of promotion through --
MR. SOBOL: I'm sorry, page?
THE WITNESS: Oh, sorry.
Page 47. Sorry.
A. We have the stock of promotion that is the continuous series that we saw plotted in that other figure, and then in Model C, I interact that with the dummy variable for the first era.

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And then I also -- I interact that separately with the variable from March 2002. So those two are essentially separate estimates over those two time periods, but in -- in the third period, because we're looking at an erosion curve, that's just literally what's happening here is opioid prescribing is eroding. I enter the interaction with that era as a trend, so then that's the sum of the stock of promotion from 2002 and the dummy trend.
BY MR. ROTH:
Q. All right. So you're jumping ahead of me. I'm going to ask you about the dummy trend.
A. Okay.
Q. But the stock in period 3 is actually overlapping with the stock in period 2; is that right?
A. Yes, the stock of promotion -- again, because the third period basically is adding on to the second period, they're being estimated -- I mean, the model of course is estimating over the entire period, but the variables are separated such that we have one

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variable that's the stock of promotion times a dummy variable, so it becomes zero at March of 2002. That's beta-1.
And then beta-2 goes a variable that's zero before 2000- -- that break date -- now I can't remember if March is the -- oh, yeah, it is March of 2002, so Table 1 was always right -- up to 2002, and then it becomes whatever the stock of promotion is, right?
And so beta-3 has that same stock of promotion and it has this multiplier effect for the trend.
Q. So what I'm trying to understand is before you put in your trend into period 3, if we recognize that there's a period, according to you, of rapid growth after efforts to market --
A. Yes.
Q. -- followed by a period of decline after growing realization about the dangers, why are those starting from the same baseline and adding a trend as opposed to having some other variable applied to the stock in Era 3?

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A. Yeah, let me try to explain that. And just to be clear, I know you know this, but let me just remind you that the turning point in the MME trend is not the turning point that marks off Era 3, right?

Q. Right.

A. That starts earlier.

One thing one could have done is just say, okay, we're going to split the model at that turning point, and so that is the light switch notion, rather than looking to see where the relationship seems to change.

And we know the relationship is such that it's -- we know conceptually, based on the other evidence, that -- and just from reading the news, that public health authorities are trying to limit opioid prescriptions and they're having some success, and so that we know that we need to put in a trend that will capture when that happens.

There's no way to have something that is an increasing trend go south without giving it the opportunity to

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have a second coefficient. And by using a trend and allowing the break to happen whenever it happens, I can actually allow the data to tell me at what pace that erosion happened.

Otherwise, I would have to sort of, again, plug it at the top and just measure the relationship on that second bar. So this was the most flexible way to use the data to look at what's happening to promotion over time. It's entirely flexible. If, in fact, you know, promotion kept going up and it was just not explaining that trend, then the model would have told me that.

Q. Okay. So now I want to get to the dummy trend.

A. Yeah.

Q. So what support do you have for using the dummy trend only in Era 3 as opposed to before?

A. Yeah, for sure. So again, because in Era 2 what we're looking at was a growing acceptance of the idea that opioids were safe, that we could have used a trend there.

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A linear shift is the simplest way of capturing that, and essentially, what will happen is then in that case, by using a shift rather than a trend, what we'll get is an average effect as opposed to one that -- where we can plot out the changes over time, if there were changes over time, but it would capture that increase either way.

When we're looking at the erosion side, however, just picking -- putting an additive effect in like the first trend, would require that we fix that really to the peak of the model in order to make any sense of -- of the way the trend reverses, and yet again, we don't -- we don't change the underlying stock of promotion. That is what it is.

If, in fact, that relationship can't be explained by the stock of promotion, then we would -- we would not get a significant coefficient on that.

Q. When you implement the dummy trend incremented by month in the third era, that means the effect of the third period stock is increasing over time still, right?

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A. Well, the effect of the stock is what it is with the negative depreciation rate. So the effect -- the stock continues to increase, as we discussed earlier, and nonetheless, the productivity of a given unit is decreasing. So relative to the previous period, the average productivity of a unit of the stock of promotion is lower.

Q. Did you try to run the model using a dummy incremented by months in the first two eras?

A. I don't believe so. Again, the simplest -- the simplest way to think about that was a slope change, and that's what we did there. It was really only when we came to trying to figure out how best to let the data tell us about this turning point that a trend seemed like the best approach.

Q. If the effectiveness of promotion is changing in each of the eras, why did you keep the depreciation rate constant the whole time?

A. We used a single depreciation rate because we think that it is something more structural. As I've talked about, the

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depreciation rate in my mind reflects the particular context here with an addictive good, so there's no reason for that to change over time.

I separate the assumption I make about the depreciation rate, which again, is empirically based, from the assumption about promotional effectiveness, which has something to do again with these environmental factors. So there are two different things.

Q. I guess where I'm missing you is I get that the effectiveness of promotion changes, right?

A. Uh-huh.

Q. As I understand the depreciation rate, that's measuring how lasting the promotion is into the future, and so what I'm missing is if the effectiveness of promotion as a whole is changing, why isn't the effectiveness of a detail into the future also changing at the same time?

A. Again, I believe that what drives the negative depreciation rate over the whole period is the addictive nature of

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the good, and so, you know, you're using words that are very useful to describe the phenomenon, but they're not a complete explanation because of the fact that we have this addictive good.

Even as physicians may have been writing fewer new prescriptions, it is still true that patients who are already on opioids are likely to be refilling those drugs with some likelihood, and so it may well be that we're capturing a lower incremental effectiveness, but still we have the long-lasting effects of the previous patients who were on these drugs.

Q. But if regulations are changing and PDMPs are coming into place and medical standards are changing, all of which are driving prescriptions and MMEs lower, why does that not affect at all the lasting effectiveness of detailing in your model?

A. It does affect sales by reducing the incremental effectiveness of promotion. That is the way that it affects it.

There's no reason particularly

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that it should be captured through the depreciation rate. The depreciation rate, again, I estimate as a single variable over time, I think that's appropriate because it captures the underlying nature of this marketplace.

Q. Did you run the model estimating different depreciation rates during each of the three eras?

A. During -- no. During each of the three eras, no, I did not.

Q. Did you consider modeling more than three periods?

A. I did not. As we've talked about, while I allow the data to tell me the turning points, I have a conceptual idea about why these two general points in time are important; that one is sort of the acceleration of opioid prescribing, and the other is the reversal.

Q. Did you consider modeling two or one period instead of having -- well, one I guess we talked about. You did that.

So -- but did you consider modeling just two periods?

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A. It's very clear that there is at least this important change at the end. It's -- it is possible that -- that the effect of the first period to the second period is small enough that we could have just used the one change, but nonetheless, it's statistically significant, that effect.

Q. And then if you look back at paragraph 70, you say for Model A, which is the one that doesn't have these eras or the events, which we'll get to -- for Model A on page 48, it does not capture well either the initial growth in opioid sales or the change that occurred in 2011.

In short, estimating Model A teaches us that there's likely a changing, not constant, relationship between detailing and sales over this long 1993 to 2018 time period that should be explored to more accurately describe the relationship.

Do you see that?

A. Yes.

Q. And the way you explored it was, as we talked about, by running the model 1100-plus times and calculating the Wald

statistic?
A. That's correct.
MR. ROTH: I'm ready to move to Model C, but how are you doing? Do you want a quick break?
THE WITNESS: Maybe a quick one. That would be great, thanks.
THE VIDEOGRAPHER: The time is 2:12 p.m., we are now off the record.
(Recess taken, 2:12 p.m. to 2:27 p.m.)
THE VIDEOGRAPHER: The time is 2:27 p.m. We're back on the record.
BY MR. ROTH:
Q. Professor Rosenthal, have you studied the addictiveness of opioids?
A. Personally, no. Again, I have reviewed various articles and reports on this, but I'm not a clinical expert.
Q. What articles and reports are you thinking of?
THE WITNESS: I'm getting sound from the phone.
A. Well, there are some articles that I believe I cite in my report, but a

number of articles, particularly in the economics literature, that talk about addiction and death and its connection to other economic phenomena, and they, of course, cite a fair amount of public health information.
I have read information from the CDC website about the opioid epidemic and the addictive nature of these products in the CDC guidelines.
BY MR. ROTH:
Q. Beyond the CDC information and the economic literature cited in your report, are there any other sources you've reviewed for information about the addictiveness of opioids?
A. There are a number of other guidelines that I cite, one from the American Academy of Emergency Medicine. I'm happy to look in my report, but there are a number that I cite in the introduction, but more so in Section X.
Q. We'll get there.
Before we do, have you reviewed any study of the rate of addiction for

specific opioid drugs?
A. No, I have not.
Q. Have you reviewed any study on the rate of the need to increase prescription for any individual opioid drug?
A. Can you explain a little bit more what you mean by that?
Q. Yeah. Sorry. Sorry.
Have you reviewed any study on increasing the dosage for a patient on opioid drugs specific to any opioid drugs?
A. Like I can't recall any specifically right now. I -- there's a paper that I cite in Section X that pertains to the treatment of cancer patients, for example, and it talks about dosing. It may talk about specific drugs, but I can't say for sure.
Q. Are you aware of the phenomenon that certain patients may have their dosage of opioids increased because they become tolerant at the lower dose?
A. Yes, I believe I described that phenomenon as well, and the allegations that the conversation around increasing dosages was some of what was manipulated by the

defendants.
Q. Do you know what the rate of opioid addiction is in either Summit or Cuyahoga County?
A. As I sit here, no.
Q. Okay. I'd like to look at Appendix D, page D5. So we talked about the first paragraph on the Wald statistic. In the second paragraph, you say: Separate from marketing efforts, there are other factors that could potentially influence the sales of opioids.
Do you see that?
A. Yes.
Q. And I think we talked about some of those factors this morning.
A. We did.
Q. And you say: While marketing to physicians is one important explanation for changes in sales, and the use of dummy variables captures broad factors that influence the market for opioids, there could still be factors that influence physicians to write prescriptions and consumers in their willingness to fill prescriptions for

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opioids.
Do you see that?
A. Yes.
Q. And so you list five events that you included in Model C to test as turning points.
A. Yes.
Q. And you say --
A. Oh, sorry. Just to be clear. You said turning points and I agreed, but these are not exactly turning points. They would be shifts.
Q. Events.
A. Yes.
Q. That's a good clarification. You've got two turning points and five events.
A. Right.
Q. Okay. And I want to look back at Table 1 in a minute, but before we do that, you say underneath this: My a priori expectation is that the first three events -- meaning the consensus statement, the Federation of State Medical Board Guidelines and the JCAHO pain standards -- would have a

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positive impact on the quantity of MMEs prescribed per month.
Do you see that?
A. Yes.
Q. And then you say: The reformulation of OxyContin could have an ambiguous impact on MME sales.
Do you see that?
A. I do.
Q. Okay. So why did you select just these five events as opposed to others we saw depicted on Figure 5 in your report?
A. I selected events. I was looking to pick some from the early period and some from the later period, and particularly from -- well, in both periods, around the time that we see acceleration or deceleration in MMEs. So they were selected really based on timing.
Q. Did you model any of the other events listed in Figure 5?
A. I did not.
Q. Are there other milestones not depicted in Figure 5 you could test as events in your model?

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A. I included in Figure 5 the major milestones that I was aware of, so I don't know that there are others that are not there.
Q. Did you try to model the five events you used in Model C against the Model A curve to see what that would look like?
A. No, I did not. The decision to do the turning points really relates to the estimated relationship between promotion and sales, and so that was the foundational model.
Q. Okay. So let's turn to Table 1, which is on page 47.
A. 47, you said?
Q. Yeah, page 47.
A. Okay. All right.
Q. And Table 1 is the output of your model, the three different models that you ran, correct?
A. That's correct.
Q. Okay. So -- and actually, you also can see in Table 1 some of the input variables at the top?

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A. I'm sorry. What do you mean by that?
Q. Sorry. The output -- well, I guess, describe what the constant and stock of promotion, those are the explanatory -- the constant is a constant, but the stock of promotion, those are the explanatory variables in your model, correct?
A. That's correct. Everything on the left-hand side is effectively an explanatory variable.
Q. Okay. I guess first, why is the constant for Model A basically twice as high as Model B or Model C?
A. Well, it's capturing sort of the unexplained average in effect, the intercept, and there's more in Model B and Model C to explain the underlying data.
Q. Okay. And then Model A actually is the one model where you have a depreciation rate that's essentially zero. It's a small positive depreciation rate.
A. They're all small, so -- but yes, it's a small positive.
Q. And then B and C both have the

negative depreciation rate that we discussed earlier?
A. That's correct.
Q. So looking at the results from Model C, the consensus statement from AAPM and APS, what do you understand that statement was?
A. It's discussed at greater length in Dr. Perri's report, but the American Academy of Pain Management and the American Pain Society had a consensus statement related to the undertreatment of pain and the need for more attention to the treatment of pain and the effective use of opioids for such treatment.
(Whereupon, Deposition Exhibit Rosenthal-11, The Use of Opioids for the Treatment of Chronic Pain Consensus Statement, was marked for identification.)
BY MR. ROTH:
Q. I'm going to mark as Exhibit 11 the consensus statement from the American Academy of Pain Medicine and the American Pain Society.

Do you have that document?
A. I do.
Q. And is this the consensus statement you're referring to?
A. I believe so. I'm just looking for a date on it. Oh, of '96. So the -- what I have is dated 1998 in my model, so I'm not sure this is exactly the same one.
Q. Yeah, I was going to ask you about that. I mean, is there another statement from 1998 you recall looking at?
A. We should look at my documents relied on.
Q. All right. So let's look at Attachment B. And as I see this, under Other Documents, four down on page B3?
A. Okay.
Q. You list the American Academy of Pain Medicine and the American Pain Society, "The use of opiates for the treatment of chronic pain," and it has got the same title as this document; is that right?
A. Yes, it does.
Q. And it looks like it was

published in the Journal of Pain in 1997; is that right?
A. Yes. Yes.
Q. And you can see from the document I just handed you that this was actually approved sometime in 1996; is that right?
A. That's right.
Q. So do you know why this was used or estimated in the model in January '98, if that's the case?
A. I'm not sure as I sit here whether there was another -- as when I was describing these events in the first instance, I was saying that there are different dates that pertain to, for example, when they're published in the Journal of Pain, in this case, versus disseminated, so I'm not sure what the 1998 date is as I sit here. I'd have to check.
Q. And if we flip back to Figure 5 --
A. Because it appears that way in Figure 5, doesn't it?
Q. That's what I was just going to

ask you.
A. Let's have a look. It does. It appears -- oh, no.
Q. Well, there's two. It looks like it's actually in '97.
A. That does look like it's '97, which would be the date of the -- of the article that I cite.
Q. Yeah. So is this something that just didn't get picked up by the errata or was the data actually run in '98 or sitting here, you just don't know?
A. Sitting here, I don't know.
Q. Okay. Regardless, whenever you ran the model to account for this statement, it estimated negative 208 million MMEs; I assume that's the unit for that, right?
A. Yes, that's correct.
Q. And we can both agree that that is directionally not what you would have expected based on the theory that this would have inspired more doctors to write prescriptions for opioids?
A. Yes, I think I say exactly that in my text, do I not?

Q. You do. You say it did not conform to your expectations, I think.
A. Yes.
Q. Let me find exactly what you say.
A. Actually, I need to -- now I need to go back and remind myself.
So it's -- that one was not statistically significant, so I don't say anything about it because it's effectively zero. I mean, as, by the way, the positive depreciation rate in Model A is effectively zero. So anything that doesn't have asterisks next to it should be treated as zero.
Q. Got it, yeah. So I'm looking --
A. I don't interpret it. It's standard practice to not interpret insignificant coefficients.
Q. Yeah. So I'm looking at paragraph 73. So you discuss only --
A. Yeah.
Q. -- the '99 federal, state medical board guidelines and the

hydrocodone rescheduling. You don't discuss the consensus statement form.
A. That's right, because it wasn't significant. So what I was recalling is it's the hydrocodone rescheduling that is counterintuitive and significant, yeah.
Q. Yeah. Although you did say in Attachment D at D5 that your a priori expectation was that this event would have a positive impact on the quantity of MMEs.
A. Did I?
Q. You did.
A. The two reformulation, then I have an errata to my errata. The two reformulation variables, as you can see in the figure, they come at a time -- regardless of whether the rescheduling itself caused a reduction in MMEs, they come at a time where the steps taken to reschedule hydrocodone are consistent with DEA and others putting the brakes on opioids.
So it should have said -- my priors -- because my priors are captured more or less in the color of Figure 5.
Q. Okay. I think I inadvertently

confused you. To be clear, you say in Attachment D that the consensus statement would have a positive effect. You said actually nothing about what the hydrocodone rescheduling would do -- oh, no, you do. You do. You say: The impact of rescheduling hydrocodone from Class III to Class II could result in a reduction of MME sales.
A. Did I -- I'm sorry, I should just catch up and read it.
Q. Yeah. Let's go to D5 so we're all on the same page.
A. I think I say that some of them are more ambiguous than others.
Q. You do say that about OxyContin.
A. Uh-huh.
Q. And then at the bottom of the penultimate paragraph, you say: The impact of rescheduling hydrocodone from Class III to Class II could result in a reduction of MME sales.
A. Right.
Q. And then if you go back to Table 1, in fact, it actually increases MME

sales.
A. Increases them, yes.
Q. And it looks like it does so in a statistically significant way because you've got asterisks there.
A. That's correct. So that is the one where we can now see what I said about that one.
Q. So you said about that one --
A. Yes, counterintuitively suggests an increase, yes.
Q. And you expected it to have the impact of decreasing MMEs?
A. I did.
Q. And what does the fact that your model showed it was a statistically significant impact mean for the validity of Model C?
A. Well, as you know, I preferred Model B in part because this suggests that there's some problem, at least with interpreting that coefficient, and it's my broader belief that, you know, we can think about the list of events that are in my Figure 5, and others, and there are many

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discrete events, all of which are picking up on broader phenomena, either a loosening of restrictions around opioids or a tightening of restrictions, and just conceptually, trying to pin any one of them to have begun at a discrete point in time seems problematic; and likely, the reason that I get a counterintuitive result is that there are other correlated -- for example, putting both the OxyContin reformulation and the hydrocodone rescheduling may have caused some interaction between the two.

And so that's also why I didn't then just try to keep adding events with the notion that this was not the right modeling approach for what was going on in this market.

Q. Okay. And then if you look back at Table 1, you mention the OxyContin reformulation, which does not look like it was statistically significant, but also resulted in estimating 107 million additional MMEs?

A. That's correct. It's zero, but positive.

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Q. Are you aware that Professors Cutler and Gruber opined that the 2010 OxyContin reformulation led to an abrupt market shift that thickened the market for illicit heroin?

MR. SOBOL: Objection to the form.

A. I am aware of their general opinions. I could not have quoted them. But I'm aware that it's more broadly understood that the reformulation of OxyContin caused a number of opioid users to switch to illicit opioids. I believe that's been shown in other literature.

BY MR. ROTH:

Q. So how do you reconcile your model showing that there's actually no effect on MMEs from the reformulation of OxyContin with their opinion that it led to some massive shift of opioid users to illegal drugs like heroin?

MR. SOBOL: Objection.

A. Well, a couple of things. First, I believe the model that I put forward in Model B, which captures the environment,

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the environment I've generally been thinking about in the third era is one in which public health restrictions are tamping down on opioid use.

That's already being captured in that dummy trend that we talked about earlier, so some of that is getting picked up, as opposed to being able to pull it out separately just at that moment in time when the OxyContin reformulation occurred. So my model is already picking that up.

You know, I think the other thing is, of course, I'm looking at the opioid market as a whole, not just OxyContin on its own, and so there are -- there are other factors happening for other opioids.

BY MR. ROTH:

Q. But your model suggests that there was still a supply of opioids and prescribing driven by promotion whereas they're suggesting that the supply was drying up to the extent that users evaded the legal prescription market and turned to illegal drugs.

A. I don't believe you're correct

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in that statement. These models are looking at two very different things. I'm not looking at the use of illicit opioids. The data show decreasing use of legal opioids. That's -- that's just the underlying MMEs, so that is happening.

My model is looking at the portion of that that's explained by promotion, so there's no way that this is disproving people had left OxyContin.

Q. But it is showing that according to your model, the OxyContin reformulation did not have a statistically significant impact on the MMEs prescribed?

A. Once you control for the variables that I've controlled for, including price, including promotion, and accounting for the change in promotional effectiveness, I don't separately find an effect here. That is not the same as saying that OxyContin reformulation had no effect.

Q. Okay. So now I want to go back to Appendix D, and I want to start with Table D.1.

A. Okay.

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Q. All right. So Table D.1 --
A. Oh. I'm on page D1.
Q. Yeah, you've got to go past that.
A. Keep going.
Q. Talk about your charts and graphs.
A. It's okay. Excellent.
MR. SOBOL: This one?
THE WITNESS: All right.
MR. ROTH: Yeah, the table.
BY MR. ROTH:
Q. So first the chart, okay. So Table D.1 is a chart that I think explains Model A; is that right?
A. That's correct.
Q. And maybe just explain to me what is on here, because if I try to ask you a question, I'm not going do as good of a job as if you just tell me what this is showing.
MR. SOBOL: If you just ask a direct question.
A. Sure. These are SAS output made slightly prettier, and so at the top -- the top box there is describing the model

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overall, degrees of freedom, the total error, the sum of squared errors you see there, the mean squared error. After that, the square root of the mean squared error. These are all sort of talking about the variability in the data and the explanatory power of what's included. The R-squared and the adjusted R-squared are -- the adjusted R-squared accounts for the degrees of freedom, the number of covariants.
BY MR. ROTH:
Q. And what is in the bottom chart titled Nonlinear OLS Parameter Estimates?
A. Yes, so those the coefficient standard error, t statistic, p values. Those are reported way back in Table 1. They've just cleaned up a little bit.
So the coefficient estimate is the one that we're interested in, and then we'll mostly just focus on the p value.
Q. Okay. So if we flip to Figure D.1 --
A. Yeah.
Q. -- which is the line graph that's an output, I was perplexed when I saw

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this because the green line is predicted but-for; is that right?
A. That's correct.
Q. So you're showing negative but-for in the early '90s and again starting around 2012.
Do you see that?
A. Yes, that's correct.
Q. So what does that mean, that, you know, people were returning opioids? I don't even understand how that conceptually works.
A. Yes. Well, remember how I said that Model A uses a single promotional effectiveness and it doesn't fit the data very well? So it's an average that's smoothing over this long period and doesn't fit the data well, so that's what these predictions tell you. It's the same thing, in effect, as looking at the adjusted R-squared. This is just what it looks like in predicted values.
Q. So for this reason, Model A is not your preferred approach?
A. This is not my preferred model,

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that's correct.
Q. Yeah. I mean, conceptually, having a negative but-for doesn't actually make sense, right?
A. Conceptually, it's unappealing.
Q. How would you even calculate the difference with a negative but-for?
A. The same way. It's -- the difference would be just the space between the two lines. I have not done that here.
Q. Okay. So now if you flip the page to Table D.2, you'll see another set of charts.
And I think this correlates to your Model B; is that right?
A. That's correct.
Q. And I assume your description of what Table D.1 is would describe D.2, although this second chart has additional labels for the stock of promotion trends that we talked about earlier?
A. That's correct.
Q. Why is the stock of promotion dummy trend from August 2010 a negative number?

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A. Again, it's an erosion rate over the promotional effectiveness in b2, and so the promotional effectiveness is b2 plus the number of months from -- from that time break, August 2010, times b3. So it increments. You see what I'm saying?
Q. Yeah.
A. So every month, it's like b2 is reduced by 8.
Q. Right. And this is your time trend essentially that we talked about before?
A. It's sort of an erosion trend, yes.
Q. Okay. And why is it -- how did you come up with that number, like how do we get negative 7.97362?
A. It comes out of the regression model. It's estimated like all the other coefficients using OLS.
Q. And what is it doing? It's not like a Wald statistic? Or is it -- how does it mechanically estimate that coefficient?
A. Well, technically through matrix algebra. I mean, it's essentially

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picking up the association between, in this case, the stock of promotion times the dummy trend and sales. Like all the other coefficient estimates, the tests relate to the statistical properties of those estimates, but the coefficients really come from the correlations.
Q. All right. And then if we turn the page to D.2, this is the line graph from your Model B, which maps almost perfectly onto the blue flow of the data.
A. Yes.
MR. SOBOL: A thing of beauty.
MR. ROTH: Almost as if it fitted like a glove. All right.
BY MR. ROTH:
Q. Let's look at Table D.3.
A. Uh-huh.
Q. The last one of these. So this is -- well, it's not the last one of these, we'll ask about that in a second, but this is, I think, Model C.
A. That's right.
Q. Okay. So the same concept as D.1 and D.2 we just walked through?

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A. Yes.
Q. And then if you look at the second page, it looks like this one has something that says Type, Wald Test -- Test and Test0. What is that?
A. That's the joint test of significance of those events.
Q. Got it. Okay.
So when you say in your report jointly they're not statistically significant, it's based on this output?
A. Yes, except that that was in the errata, that that should have said they were significant.
Q. I saw that. That was the one errata where it changed like a no to a yes and there was --
A. Yes. It does not change my conclusions, but yes, you can see here the p value is .0176.
Q. Okay. So just to be clear, your opinion is that jointly the five events are actually statistically significant?
A. That's correct.
Q. Okay. And then if we look at

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D.3, Figure D.3, this is what your curve looks like in Model C?
A. Yes.
Q. Okay.
A. Not very different from Model B.
Q. Which makes sense because the baseline is Model B; you're just inserting five events and measuring those?
A. Yes. If they had had some effect, it might have looked different.
Q. Okay. You can -- looking at your report again, so we talked about this earlier, but you cited Datta and Dave, and we talked about that article this morning.
Do you remember that?
A. I do.
Q. So let's pull it out one more time. Probably the last one.
A. Let me make sure that I get the right...
Q. It's Exhibit...
A. 5. Got it.
Q. 5.
So if you look with me at

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page 452 again, we're now going to get to talk about endogeneity.
A. Excellent.
Q. You knew it was coming.
A. I did.
Q. So at the top of the page, they say: A key empirical concern in this literature relates to potential targeting bias, which physicians who already have a history of prescribing a particular drug or who have a higher unobserved likelihood of prescribing the drug (for instance, due to their patient population or practice type) more likely to be targeted by detailers.
Do you see that?
A. I do.
Q. And is that an empirical concern that you as an econometrician or economist would have?
A. If I were doing a physician-level study, yes.
Q. And one could describe this issue as something called endogeneity?
A. Yes.
Q. And can you define endogeneity

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for us?
A. Well, in effect, what they're talking about here, I described earlier this morning the endogeneity they're concerned about is of the type that physicians who are more likely to be detailed are already more likely to be open to prescribing or are, in fact, high prescribers already.
Q. And it's called endogeneity because that's an endogenous problem?
A. Yes. The level of detailing is endogenously determined with the level of prescribing.
Q. So continuing on their paper, they say "Addressing such endogeneity is a vital issue in identifying plausibly causal effects of advertising, which would otherwise lead to overestimates of the advertising response.
Do you see that?
A. I do see that.
Q. And --
A. And as I said before, it's because they're talking about physician-level data.

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Q. Which you didn't look at?
MR. SOBOL: Objection, asked and answered.
A. It was not relevant to my report because I have been asked to conduct an aggregate analysis.
BY MR. ROTH:
Q. And then they say: Studies that address this endogeneity in most cases have done so through an instrumental variables-based methodology, although as Bronnenberg caution, many of the instruments employed have limited variation and may not fully satisfy the validity requirements. This caveat notwithstanding, these studies generally find a smaller marginal effect of detailing relative to those that do not account for endogeneity.
Do you see that?
A. I do.
Q. Now, what about having an aggregate macro analysis means that endogeneity is no issue for you?
MR. SOBOL: Objection.
A. Well, endogeneity is something

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different in every context, so what they're describing specifically here, I mean, I think they say that they're talking about targeting bias, so that's the physician-level concern.
It simply doesn't exist in my data because I'm not looking at physician-level data. I cannot mistake the fact that Doctor A has high prescriptions compared to Doctor B, not because she's been detailed before, but she's been detailed before because she has high prescriptions. Because I'm only looking at the aggregate. So the only kind of endogeneity there, it can't be related to targeting. It has to be related to something else.
In other instances people have looked at endogeneity when it comes to a specific product. They said, well, you know, we knew that this product was going to be a blockbuster so we put our detailing on product A versus product B, and so that's the nature of the endogeneity. But again, I don't have that here because I'm aggregating across products.
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BY MR. ROTH:
Q. It's a convenient answer to everything, but I want to dissect that.
The data you're looking at --
MR. SOBOL: Well, objection to that.
BY MR. ROTH:
Q. The data you're looking at from IQVIA is an aggregation of detailing contacts to doctors, correct?
A. The details were made to doctors, yes.
Q. Or healthcare providers. Actually, could have been nurse practitioners, as we talked about earlier?
A. Yes.
Q. Why is it that adding up a whole suite of contacts to doctors is any less susceptible to the fact that certain doctors are more likely to be detailed in the first place than looking at it on a disaggregated individualized basis?
A. You're making me feel like I'm failing as a teacher. Let me try again.
MR. SOBOL: Yeah.

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A. It's the fact of measuring, detailing and prescribing at the doctor level and trying to examine that specific relationship that's causing the endogeneity problem.
So imagine that -- I'm trying to give a work example for you, but I mean, the concern again is that the patterns of high prescribing that we're observing between doctors are really causing detailing and not the other way around.
But if I am ignoring those patterns, the only thing that I'm looking at is increases over time. Those -- the forces that say which doctors get detailed are just not -- they're not in my data.
So it's like doing an intent-to-treat analysis, if that means anything to you. We have clinical studies where we know that some patients will be compliant and some won't, and if we only look at the effect of the drug on the compliant patients, we're going to misstate its population effect, so we look at all patients.

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That's basically what I'm doing is it may well be that targeting is happening here. If that is true, then the aggregate effect will be small. In the extreme, where promotion doesn't work at all, it just -- detailing -- we just, you know, detail the doctors we know are going to prescribe, then I would find no effect in the aggregate. Even though you would find an effect in the cross-section, you won't find it in the aggregate.
BY MR. ROTH:
Q. We may have to agree to disagree on this one for now. I can't promise we won't come back.
Do you agree that when endogeneity is an issue, it's typically handled through instrumental variables?
A. Yes, that is a classic approach. In effect, the instrumental variables are trying to step back from -- from that targeting to get to something that is, in fact, exogenous.
Q. Are there other options for addressing endogeneity?

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A. Well, generally, there's sort of broader research design, so ultimately, endogeneity concerns some kind of unmeasured third variable. I mean, there's simultaneity that has to do with sort of a different interpretation of endogeneity, but what we're talking about here is something else that we're not measuring. So endogeneity can be addressed by measuring whatever that thing is. So in the case of Datta and Dave, it could be historic prescribing.
Q. Did you take any effort to test for endogeneity issues or address endogeneity issues in your regression analyses?
A. Again, conceptually, I don't believe this is an issue looking at the overall opioid market over time, so I did not address endogeneity in my model.
Q. Do you know if anyone on your team did?
A. I do not.
Q. You've used the instrumental variables methodology to correct for endogeneity in other models you've developed for litigation, correct?

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A. In looking at a single drug, yes. As I mentioned, there's another version of the endogeneity story that makes sense for a single drug.
Q. So in Zyprexa, I think, for example, you used instrumental variables?
A. I'm afraid that was a long time ago. I didn't review that report for that.
Q. I can mark it just so we have it in the record.
(Whereupon, Deposition Exhibit Rosenthal-12, Rosenthal Declaration re: Zyprexa, was marked for identification.)
BY MR. ROTH:
Q. Exhibit 12 is your --
A. Wow.
Q. -- declaration from Zyprexa, Analysis of Class-Wide Impact and Estimation of Damages.
MR. SOBOL: Oh, wow. Memories.
A. I'm trying to -- do you know what the date on this is?
BY MR. ROTH:
Q. It is February 2007.

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A. Wow.
Q. 12 years ago.
A. That is a really long time ago. Yes.
Q. Okay. And if you look at your Zyprexa declaration -- and I will stipulate this is an excerpt, we didn't print the whole thing, but at paragraph 35 you talk about the fact that you developed a regression model, and then the equations in paragraph 37.
Do you see that?
A. Yeah, I was just looking at -- I was trying to remember whether this is a panel data model or not, but --
MR. SOBOL: Well, take your time then to refresh your recollection of your model from 12 years ago.
THE WITNESS: I will. Yes.
A. Yes, this is a panel data model for the atypical antipsychotic class.
BY MR. ROTH:
Q. And if you were to try to assess the effect of any individual defendants' promotion in this case, would you put together a panel data model similar to

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the one you used in Zyprexa to do that?
A. I have not thought about doing defendant-by-defendant analysis in this case. It was not part of my assignment. I'm not sure if that would be appropriate, again, because the interest here, even if we're looking at individual defendants, is on the overall -- on the market expansion aspect of their marketing.
Whereas in Zyprexa, we were very interested in the -- I'm trying to remember what words we used this morning -- business dealing is the way economists usually describe it. Marketers describe it something differently, but the market share shifts, those were relevant in Zyprexa because the question was not so much that Zyprexa was trying to grow the market, although there was some of that. It was about trying to encourage doctors to substitute Zyprexa in place of first-generation antipsychotics.
Q. For a manufacturer that was not part of the market before it grew and came into the market after it had been expanded,

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why is it the case in your model that that manufacturer is part of the aggregate analysis and not subject to some other type of causation allocation?
MR. SOBOL: Objection, asked and answered.
A. Nowhere in my assignment was I asked to look at liability for individual manufacturers. I'm only trying to quantify aggregate impact. To the extent that I subtract individual defendants, it's really only to get to a different whole, it's not to assign liability to an individual defendant.
BY MR. ROTH:
Q. So looking at the Zyprexa declaration, paragraph 42, you say: For purposes of the regression, the promotional variables for Zyprexa and its competitors were entered as discounted stocks following the tendency of the published literature and in accordance with the theory that promotions to physicians is habit building.
Do you see that?
A. I do.
Q. So you used a stock of

promotion with a depreciation rate similar to here?
A. At least I'm consistent, yes.
Q. No doubt.
And then you also used a Fisher Ideal Price Index in that case too?
A. I did.
Q. But you weren't consistent next, because then you say: In addition, the estimation deals with two important issues, serial correlation in the error terms and the endogeneity of price and promotion. Serial correlation in the error terms require the use of time series methods to produce reliable estimates. The endogeneity of price and promotion was handled using the standard instrumental variables approach.
Did I read that correctly?
A. Yes, you did.
Q. And if endogeneity is an issue for you -- I understand you don't think it is -- but if it is an issue for you, your regression may lead to overestimating the response to promotion?
MR. SOBOL: Well, then,

objection.
A. I do not believe endogeneity is an issue in my model for the reasons that I've described. But in particular, what we're looking at is an aggregate phenomenon, and so the theory of endogeneity that we would have to have requires this reverse causation on a month-by-month basis for the market as a whole, and I do not believe that's a plausible notion.
BY MR. ROTH:
Q. Okay. Don't fight the hypothetical, though.
Assume endogeneity is an issue with your model. What impact would it have?
MR. SOBOL: Objection, asked and answered.
A. I cannot imagine a form of endogeneity that would make sense in this case. I cannot understand how it could be that one month's sales could have caused the next month's detailing to change in the way that endogeneity requires. It's simply not a plausible set of ideas in this context.
///

BY MR. ROTH:
Q. And why is that again?
A. Because we're looking at the market as a whole, and not individual manufacturers or individual drugs, where those decisions are made.
Q. I guess I'm confused, because earlier you talked about us as this manufacturing ecosystem that all kind of acts together, but now for purposes of endogeneity, you're saying there are no issues because we're not looking at it on an individualized basis, and I can't square those two things. Maybe you can help.
A. Sure.
MR. SOBOL: I'll object to the form, but go for it.
A. Sure. I think where you're confused is the ecosystem is causing prescribing in a way that may be concerted, but I -- I don't believe anywhere I have said that the defendants are aligning, explicitly, their marketing efforts.
BY MR. ROTH:
Q. Okay. Do you remember if you

used an instrumental variables approach to address endogeneity in Neurontin?
A. All not quite 12 years ago, 17, however many, but I believe the answer is yes, in the circumstance of -- thank you, can you remind me -- the circumstance is very similar to the Zyprexa matter.
Q. Yes, so we can do this one quickly.
A. Yes.
Q. But Exhibit 13 is your Neurontin declaration, excerpted.
(Whereupon, Deposition Exhibit Rosenthal-13, Rosenthal Declaration re: Neurontin, was marked for identification.)
A. It's in Calibri too.
BY MR. ROTH:
Q. It must be the Greylock computers. Did Greylock McKinnon assist you there?
A. Yes.
Q. August 2008.
So looking at your Neurontin declaration, you were addressing alleged

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fraudulent promotion on behalf of the class plaintiffs; is that right?
MR. SOBOL: Actually, may I just interrupt one second? Sorry.
So is this pulled online or -- it indicates confidential in the bottom left-hand corner.
MS. VENTURA: It's available online.
MR. ROTH: Yeah, we got it online.
MR. SOBOL: Okay, go ahead.
THE WITNESS: Zyprexa too?
MR. ROTH: I think so. I did ask that question.
MR. SOBOL: Zyprexa had at the top an ECF thing. This one didn't. That's why I asked. I'm sorry. Go ahead.
BY MR. ROTH:
Q. So in Neurontin, you offered opinions on behalf of the class plaintiffs related to the defendants' promotion; is that right?
A. And coordinated plaintiffs -- I

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was just trying to see -- yes, that's right.
Q. And then your regression is in paragraph 34.
A. Yes.
Q. And then in paragraph 40, under Prices, there's a sentence toward the end that says: The endogeneity of price and promotion was handled using the standard instrumental variables approach.
A. Yes, that's correct.
Q. And that's actually a different endogeneity than what Datta and Dave were describing.
A. That's correct.
Q. And is that endogeneity an issue for you here?
A. I think again, because we're looking at a market average set of prices, that that is not the same as thinking about the simultaneity of price and quantities for an individual manufacturer.
Q. Okay. I've got one more source for you. We're just taking the time machine into the farther back.
A. Oh my gosh, is there farther

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back? Yes.
(Whereupon, Deposition Exhibit Rosenthal-14, 2003 Kaiser Family Foundation Report, was marked for identification.)
BY MR. ROTH:
Q. Exhibit 14, Demand Effects of Recent Changes in Prescription Drug Promotion, the Kaiser Family Foundation, and you are one of the authors.
Do you see that?
A. I do.
Q. And Professor Berndt is a co-author of yours.
A. That is correct.
Q. And in this article, it looks like you're analyzing whether increases in direct-to-consumer advertising increased the market share of an entire therapeutic class, right?
A. Yes. So maybe just briefly, this analysis is a panel data study. We have a couple of years of data, I think three years of data, for five different classes of drugs. And we do the analysis both at the

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class level and then at the individual product level.
Q. But at least a part of this was aggregated, correct?
A. At the class level, yes.
Q. Okay. Let's look at page 14.
MR. SOBOL: What about page 1? It's got a quote from Kessler on it.
MR. ROTH: Look at that, David A. Kessler, along with laureates Thomas Jefferson and F. Scott Fitzgerald.
THE WITNESS: It would not be appropriate to comment on the quotations in this paper.
BY MR. ROTH:
Q. So page 14 --
MR. ROTH: Hold on.
(Comments off the stenographic record.)
BY MR. ROTH:
Q. Hold on, Professor. I am on the wrong page, I think.
A. Okay.
Q. Or hopefully not on the wrong

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article, but it could be.
(Document review.)
BY MR. ROTH:
Q. Okay. It's actually page 12.
A. Okay.
Q. I was looking for a sigma, which was a dead giveaway that I was on the wrong page.
A. Okay. Excellent.
Q. Okay. And I think it's because this is probably a reprint from the journal, so I'm looking at a snapshot of the journal in my outline.
A. I see.
Q. Okay. But now we're on the same page, the section that says Basic Models.
A. Okay.
Q. Do you see that?
A. I do.
Q. It says: We now set out the basic estimation models used in the analysis. As noted above, the Cobb-Douglas formulation is used for both the class level demand model as well as the individual product demand

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model.
Do you see that?
A. I do.
Q. So it's both class and individual, and then you've got your equation below it.
Do you see that?
A. I do.
Q. And can you say it in words? Because you did such a nice job earlier and I don't read algebraic.
A. Sure. Well, that Cobb-Douglas specification has natural logs on both sides, and so it has the log of quantity sales is a function of alpha, beta-1 times the log of direct-to-consumer advertising plus beta-2 times the log of detailing plus the other coefficients at times their values.
Q. So I'll take a detour because I had another question about this for you later.
A. Okay.
Q. So by "log," you mean logarithmics, right?
A. That's correct.

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Q. And there's a difference between using logarithmics or some non-logarithmic variable in a regression model?
A. Yes. You make logarithmic sound so poetic, but yes, it is -- generally when we use logs, we're trying to collapse across the orders of magnitude, and it frequently permits interpretation of results in terms of proportions.
These log-log models have this specific Cobb-Douglas production function under them, which is just something that is frequently used in economics.
Q. Got it.
So it says -- and then you have this general specification of a modified AIDS model.
A. That's correct.
Q. And below that, it says after explaining that model: Finally, we use the same right hand side variable in estimating model specifications where the dependent variable is specified as the logit of quantity squares for the individual drug

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products.
Do you see that?
A. Yeah. That's the logit.
Q. Legit, sorry.
A. It's all right. Logit.
Q. With an O, not an E.
A. It's a transformation.
Q. All right. So now if you look at page 14, it says: We take account of the possibility that spending on DTCA and physician promotion and product sales are jointly determined by estimating instrumentable -- instrumental variables, IV, models where all three variables are assumed to be endogenous.
Do you see that?
A. Yes.
Q. And that's solving for an endogeneity issue?
A. That's correct. This, again, is at the product level.
Q. And if you had done an analysis at the drug- or geography-specific level, this is an approach you might have had to take?

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A. I did not do such an analysis for -- based on my assignment, and so I really haven't sat and thought about it.

But this model I believe is appropriate for a product-level model, again notwithstanding the challenges in estimating instrumental variables in general.

Q. So even if you're right, that selection isn't an issue because it's an aggregate model at the prescriber level, aggregate promotion across all manufacturers could still be determined at least in part by sales in the aggregate, right?

MR. SOBOL: Objection.

A. Well, again, conceptually, and ultimately endogeneity is a conceptual issue about how we understand the market to be working.

Conceptually, it makes no sense to me to think about an aggregate price being set by anyone because it is looking across a wide range of companies and products, and so in terms of the price endogeneity, that is literally about strategic decisions of individual firms and I don't think it

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translates into the aggregate level.

Likewise, when it comes to detailing, we're assigning the detailing to the class as a whole and it's not the class as a whole that's deciding a detailing budget. That's for an individual manufacturer at the product level.

So conceptually, I think they're disconnected.

BY MR. ROTH:

Q. Okay. But if we assume that pharmaceutical companies are economically rational actors, it would make sense for them to consider recent sales performance when setting promotional budgets?

A. I again -- I guess I can just say it again, that pharmaceutical manufacturers, the concern is that they're looking -- they're anticipating their own sales growth and setting detailing based on that.

While that may make sense for an individual manufacturer, I -- even though those decisions are rolled up in my aggregate, the aggregate then is one step

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removed from the timing of those decisions and so the concern that the factors that determined the level of detailing for the -- for the market as a whole in that month are the same as determined as sales, to me that makes no sense.

Q. Okay. If you were to use an instrumental variables approach, instruments for promotion would need to be correlated to promotion; is that right?

A. In general, in an instrumental variable approach, you need instruments that predict the endogenous variable and only affect the variable of interest through the endogenous variable and not on their own.

Q. Okay.

(Whereupon, Deposition Exhibit Rosenthal-15, Regression Instruments Spreadsheet, was marked for identification.)

BY MR. ROTH:

Q. I'm going to mark as Exhibit 15 a document that was produced along with your backup materials, and it says Regression Instruments, Checked on July 24th, 2018.

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A. Yes.

Q. Do you see this?

A. I do.

Q. So that's in part why I asked you before if you knew about this.

A. This is not part of my analysis. So as you may know, I was retained in the middle of the summer, so this was not part of the analysis that you see in my report.

Q. So who would have performed this regression instruments analysis on your models, if not you?

A. Presumably the staff began gathering these data.

Q. So at least someone on the staff thought that endogeneity might be an issue if they determined to run this analysis in July 2018?

MR. SOBOL: Objection.

A. Like you, they may have been operating on my past analyses and started to collect the data on that basis.

BY MR. ROTH:

Q. And I know your position is

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that this didn't need to be done, but if you look at the nine variables on Exhibit 15, some of these look familiar from your Neurontin report, but others are not ones I recognize.

Can you comment on that?

MR. SOBOL: Objection.

A. Well, I haven't seen this. Again, like you, I can imagine my staff would have gone back to my last report, maybe not quite as old as these, and looked at the instruments that were gathered for those reports.

Generally speaking, these look similar in that they are consumer price and producer price indexes, indices, and wage index. They look familiar to the ones that we've used in the drug-level studies.

BY MR. ROTH:

Q. So you didn't do this or see this before just now?

A. I -- I did not see this, no.

Q. Okay. And your view is you have no endogeneity issues because you've done an aggregate model, and pricing is not

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an issue either, so we don't need to use instrumental variables on your model.

MR. SOBOL: Objection, asked and answered.

A. As I sought to address my assignment, it was my belief that we should use an aggregate model and that in doing so, the endogeneity issues around the timing of and extent of detailing for specific drugs would not be pertinent.

BY MR. ROTH:

Q. Did you conduct any study or analysis to evaluate whether the manufacturers' detailing targeted physicians with a history of prescribing their drugs?

A. I'm sorry, could you repeat that? That was a long sentence.

Q. Did you conduct any study or analysis to evaluate whether the manufacturers' detailing targeted physicians with a history of prescribing their drugs?

A. Not specific analysis. I would have to review my report carefully to see if I don't cite documents. It is -- in the course of my work on pharmaceutical matters,

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I have been aware that manufacturers do, in fact, target high prescribers.

Q. And I think we've seen throughout today you've relied on Dr. Perri.

A. Dr. Perri, of course, is a pharmaceutical marketing expert, and I certainly cite him on those matters.

I have my own general working knowledge, having seen many documents in the course of discovery about targeting efforts.

(Whereupon, Deposition Exhibit Rosenthal-16, 3/25/19 Perri Expert Report, was marked for identification.)

BY MR. ROTH:

Q. I'm going to hand you Exhibit 16, which is an excerpt of Dr. Perri's report. And if you look at page 42 -- sorry, paragraph 42, which is at page 23. Do you see that?

A. Yes.

Q. He says: Marketers frequently target prescribers who are most likely to prescribe their drug. Marketers identify prescribers using commercially available

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data, which groups prescribers, for example, into deciles reflecting lower versus higher levels of prescribing.

Do you see that?

A. I do.

Q. And then it says: Marketers use this information to select prescribers, or groups of prescribers, as target customers. Targeting high-decile (more frequent prescribing) prescribers is consistent with marketing principles because it effectively targets customers with potential to generate sales. Defendants used deciles to identify the best physicians for their PSRs to use in sales plan -- sales call planning.

Do you see that?

A. I do. I think that's exactly what I have said.

Q. And you agree with that. Your point is just when you aggregate everything, you don't need to account for the targeting issue?

MR. SOBOL: Objection.

A. If I -- if I were looking at

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individual physician data, it would be important to account for this. I am not, and therefore this concern does not pertain to my analysis.
BY MR. ROTH:
Q. Okay. Did you consider any methods to test causation that are not included in your report?
MR. SOBOL: Well, other than drafts, right? How do we even navigate that?
BY MR. ROTH:
Q. I mean, I guess what -- the only -- I'll ask it this way.
The only tests for causation of your model are contained in your report? Let me strike that. That's a bad question. I'll just -- I don't need to get drafts. I'm not trying to get at that.
Did you consider whether you could leverage any natural experiments to determine whether MMEs were impacted by promotion?
A. Because my assignment related to the whole of this period of interest --

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well, the logical research design to examine the effect of 20-some-odd years of promotion is the one I have done.
I was going to say in some sense the indirect analysis and my Section X, which I assume will be a Sunday afternoon activity, is like a natural experiment, right? It's saying what would have happened absent promotion.
Now, how would all other factors have driven this forward? Those are, in effect, event studies.
Q. It's a thought experiment, but it's not like a regression analysis or event study.
MR. SOBOL: Objection.
A. Well, the -- of course the indirect model uses a regression to establish which factors seem cross-sectionally associated and then trends that forward, so the causal part is in the cross-section.
It's hard to imagine an event study of another kind that would be appropriate to capture the effect of the alleged misconduct from 1995 through 2018, so

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I don't think I considered it.
BY MR. ROTH:
Q. Did you consider a difference-in-differences approach?
A. Again, because the alleged misconduct in this matter pertains to all marketing from 1995 to 2018, there wasn't an obvious difference-in-difference approach that I thought would make sense here.
Q. Did you run your model switching the dependent and independent variables to see if MMEs predict detailing?
A. No, I did not.
Q. And that would be a test for reverse causation; is that right?
A. I'm not sure that would be the best test for a reverse causation, but it certainly is literally a reverse model.
Q. Did you run a model including a lead of detailing contacts from the next month as an independent variable to see if future detailing predicted current MMEs?
A. I did not, no.
Q. Did you do any test of reverse causation?

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A. I did not.
Q. And what would it mean if there was a significant positive relationship between future detailing and current MMEs?
MR. SOBOL: Objection.
A. Well, again, I proceed on this question of endogeneity from a conceptual basis. I struggle a bit with thinking about exactly what it would mean. On the -- at the individual drug level, I think there's a clear story. At the aggregate level, it's a lot less clear to me.
BY MR. ROTH:
Q. Okay. If there comes a point in time when, for whatever reason, certain defendants are not part of the trial, is it your intention to use your aggregate model along with Table 3 to identify causation percentages for the remaining defendants, or do you have some other approach in mind?
MR. SOBOL: Objection.
A. Well, the reason that I undertook the analysis for Table 3 was that I was asked by counsel if it was possible to remove one of the defendants or any group of

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the defendants from the measure of impact that I use, and so I did that by removing their marketing from the calculation, which is, in effect, leaving it in the but-for scenario.

And so do I know for sure that that's the way the court will ultimately want to remove a defendant? I don't know for sure, but that was what -- I was asked if I could do that by counsel in order to demonstrate one way that the model could be adapted for fewer defendants.

BY MR. ROTH:

Q. I'm going to switch gears and talk about your price index for just a few minutes.

A. Okay. Sure.

Q. Do you know whether the price index you calculated is increasing or decreasing over time? And feel free to refer to the --

A. Yes, it doesn't change much. It does increase slightly over time.

Q. How does that square with the fact that the share of generics relative to

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branded drugs was also increasing over the same period of time?

A. Oh, sure. Well, you're asking me about my favorite subject, which is drug pricing. So even though the share of generics may be increasing, the price of those generics is also increasing; and there's a bolus of people who are already on generics, so as the price of generics increases, the price index increases. And then, of course, there are new drugs and line extensions, and those are priced higher and higher.

So all of those forces together are getting us to -- it's a very low rate of increase, but it is slightly positive.

Q. And did that index measure the actual prices, or was that derived through some equation, the Fisher Ideal Price Index you use in your model?

A. The Fisher Price -- Fisher Ideal Price Index, sorry, not Fisher Price. It's late --

Q. That's where our heads should be on Saturday, but we're all hanging out

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here.

A. Yes, right. Exactly.

Q. Let me ask a clean question.

A. Okay.

Q. Did the Fishiarial [phonetic] Pricing -- Ideal Price Index used in your model look at actual opioid prices, or was it derived through some equation?

A. It looks at actual transaction prices for opioids.

Q. Okay. What is the unit of measure you used in calculating the price index?

A. The price index is weighted on MMEs.

Q. It's not weighted on extended units?

A. Well, I should check, but -- I should not do anything by memory. Let me look in my report. I apologize.

Q. It would be logical if it were weighted by MMEs, but I think it might be weighted by extended units, so you should check.

A. Let me check.

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(Document review.)

A. It's weighted by extended units. Yes.

BY MR. ROTH:

Q. Would it not be more logical to weight it by MMEs, given that that's your dependent variable?

A. Well, given that MMEs and extended units track almost perfectly, I think it would make no difference. And I of course run the model both with MMEs and with extended units, so it happens to be using extended units.

Q. But you haven't run your price index with MMEs to see what that would look like?

A. I haven't seen that, no.

Q. And we talked about the potential endogeneity issues with pricing. I take it you have not run instruments on your pricing index?

A. Again, because I'm using an aggregate model and, in fact, the total quantity and total prices are not simultaneously determined in the market as a

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whole, I do not believe it is necessary.
MR. ROTH: I think we should take another five-minute break.
THE WITNESS: Okay.
THE VIDEOGRAPHER: The time is 3:35 p.m. We're now off the record.
(Recess taken, 3:35 p.m. to 3:50 p.m.)
THE VIDEOGRAPHER: The time is 3:50 p.m. We're back on the record.
BY MR. ROTH:
Q. So we started the day with a long discussion of factors that influenced doctors' prescribing decisions. Do you remember that?
A. I do.
Q. All right. I want to take it a step broader.
What are the factors that drive sales of prescription opioids?
A. Well, the factors that I account for in my direct model are price and promotion; and promotion, of course, is the most important driver of overall sales.
Q. But there are other drivers

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apart from price and promotion for opioid sales; is that right?
A. I think when we talk about drivers, I think it's important to be careful to distinguish between things that may determine whether a particular patient or doctor receives or prescribes an opioid versus what increases the size of the market over time. And when it comes to the latter, I think promotion is really the dominant factor.
Q. Would opioid sales still occur if they were never promoted?
A. Do you mean never from the beginning of time? Perhaps at some level. But when we are talking about this class that has been promoted for many years, I think just stopping it at a point in time wouldn't result in those sales being eliminated.
Q. You have a but-for world that eliminates promotion from the world, then you still find there are opioid sales, right?
A. I have a but-for world that eliminates promotion for the defendants, for that period of time, although I start my

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analysis earlier so the stock of promotion has a chance to build up somewhat.
So yes, I don't -- I clearly don't drive sales to zero with that reduction.
Q. And you said, I think, your direct model includes only promotion and prices as the two variables.
A. As the two explicitly covered variables, yes.
Q. Do socioeconomic factors influence sales of opioids?
A. When it comes to the trends, if they have any effect, it's very small. And that's really captured in the indirect model when we look at that. It's a little easier to have that conversation when we have those data in front of us.
But I think they do very little to explain the expansion of the market over time, as opposed to they do explain some of the cross-sectional variation in opioid use.
Q. Do demographic factors impact the sale of opioids?
A. Demographic factors, like

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socioeconomic factors, may well explain some cross-sectional variation. Older populations maybe have a higher incidence of cancer and therefore more opioids.
But over time, even though people do worry about the aging of the population, it's an extremely slow phenomenon; and again, in the indirect model, those age variables do very little to increase the sales of opioids.
Q. Do healthcare factors impact the sale of opioids?
MR. SOBOL: Objection to form.
A. Health -- healthcare factors such as -- perhaps do you mean insurance, health insurance? We talked a little bit about that this morning.
Again, there will be cross-sectional differences between people's coverage, and that will surely determine whether some patients ever go to the physician and therefore get a prescription. So as a cross-sectional matter, those may have some explanatory variable.
In the indirect analysis, we

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see that driving very little of the change.
BY MR. ROTH:
Q. And as you pointed out, you modeled socioeconomic, demographic and healthcare factors in your indirect model.
A. Yes, because I'm able to use that approach to exploit the cross-sectional variation to capture those effects reliably, whereas because they change so little on the aggregate year over year, it would be very hard if not impossible to do that in the time series.
Nonetheless, using trends in those underlying demographic, socioeconomic and healthcare variables, I find that there's very little of the growth in opioids that's associated with those factors.
Q. Did you attempt to run your direct regression with demographic, socioeconomic, and healthcare factors as variables?
MR. SOBOL: Objection.
A. I did not, no.
BY MR. ROTH:
Q. And why not?

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THE WITNESS: Bless you.
MR. SOBOL: For the sneeze, not the question.
THE WITNESS: Yes.
A. For the question, those -- at the national level, as you know in my model, those variables show very little variation over time. If one were to try to put them in a model, they would predict very little of the sales. And you can see from the literature that we've reviewed today, none of these studies enter variables such as these.
BY MR. ROTH:
Q. All right. If we can go back to the G?n?l study, Exhibit 10. Did we not use that one yet? We did, I think, yeah.
A. No, I don't remember looking at it.
Q. Yeah, it's Exhibit 10. We looked at it quickly.
A. I'm afraid mine are out of order.
MR. SOBOL: This one here.
THE WITNESS: Thank you. It's just probably at the bottom. Thank

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you.
BY MR. ROTH:
Q. Page 80.
A. Yes.
Q. So bear with me. You know what, let's do this. Let's first go to the Mizik and Jacobson study.
A. Okay.
Q. Which is Exhibit 9.
A. And what page would you like me to look at?
Q. 1707.
A. Okay.
Q. And actually it starts on 1706, so I'm sorry about that.
A. Okay. That's fine.
Q. So they're talking about the G?n?l study. Do you see that at the bottom of the right column?
A. Yes, I see that -- sort of right midway down the page, they start talking about it.
Q. Yeah. And they say at the bottom of the page -- well, yeah. So midway down the page they say they use data

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involving 1,785 patient visits to estimate a multinomial logit model assessing factors influencing physician prescribing behavior.
Do you see that?
A. I do.
Q. And then the next paragraph says: A concern, which G?n?l et al explicitly acknowledge, is over the role of physician-specific effects that can induce a bias in the estimated coefficients. They state "prescription behavior patterns might be strongly influenced by factors other than the explanatory variables we include in our model. Examples are physicians' unobservable personal characteristics. Ignoring these factors might bias the coefficients of the included explanatory variables."
Do you see that?
A. Yes. This is the subject that we've been discussing a great deal this afternoon about these -- it's the same as the endogeneity concern, which is fundamentally about an omitted variable at the physician level. So the concern is about cross-sectional variation, not about time

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series variation.
Q. Okay.
(Whereupon, Deposition Exhibit Rosenthal-17, 2007 Steinman et al Publication, was marked for identification.)
BY MR. ROTH:
Q. And then let me mark as Exhibit 17 the Steinman study, Characteristics and Impact of Drug Detailing for Gabapentin.
Do you have that document in front of you?
A. I do.
Q. And is this a document you reviewed and quoted and relied upon in your report?
A. It is.
Q. So it looks like from the cover page, for this study this evaluated off-label promotions for gabapentin by analyzing forms on specific detail visits to specific doctors between 1995 and 1999.
Do you see that?
A. Yes, I do.

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Q. And at page 748, in the right paragraph -- I'll wait until you get there.
A. 748, right paragraph.
Q. Do you see "Our study has several limitations"?
A. Yes.
Q. And in that paragraph, they say: Third, the self-reported intention to increase future prescribing or recommending of gabapentin might have been affected by factors other than the detail. Thus, we cannot prove a causal relationship between the detail and self-reported behavior change.
Do you see that?
A. Yes. Again, this is a cross-sectional analysis.
Q. And is it your testimony that no aggregate time series regressions ever run instrumental variable tests to account for endogeneity?
A. No, that was not my testimony. It depends a little bit on what you mean by aggregate. The analyses that I know of, including my own, that have used instrumental variables have been product-level analyses.

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Even though the Kaiser Family Foundation report we looked at does some class-level analysis, all the instrumental variables are at the product level.
Q. Got it.
A. I can't say for sure that there's no model that aggregates above that level that uses instrumental variables. I haven't seen one, but...
Q. So you raise a good point. I mean, all of the peer-reviewed published studies we've looked at today have related to cross-sectional drug-specific models of marketing.
A. The panel, so some of them have time series. This one doesn't have any time series variation, but some of them have both cross-sectional and time series variation, but they all at least have some product level variation in them.
Q. And as we talked about, your model does not do that?
A. My assignment --
MR. SOBOL: Objection, asked and answered.

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A. -- is about an aggregate phenomenon, which I appropriately characterize with an aggregate model.
BY MR. ROTH:
Q. Okay. In your direct model, did you consider adding a variable for lagged sales?
A. I did not.
Q. Did you consider adding a variable in your aggregate model for nonmarketing misconduct?
A. Well, I did add those event variables that I considered to be associated with nonmarketing misconduct.
Q. That's a good clarification. Beyond the five events in Model C, there's no variable for nonmarketing misconduct in your direct model?
A. There is not, no.
Q. And just to confirm, Model C is the same as Model B with the addition of the five events?
A. That's correct.
Q. Did you consider adding a variable to your direct model for illegal

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prescribing?
A. I'm sorry, can you explain what -- what that would look like?
Q. You're the economist. You probably have a better idea of how to put that into a study. But is that something you considered doing?
A. What is --
MR. SOBOL: Objection to the form.
You're the lawyer. What's illegal?
THE WITNESS: Yes, sorry, that's my question.
MR. ROTH: I asked both of you.
A. Well, as I understand this case, it is not about illegal prescribing but illegal promotion, and those are two different things.
BY MR. ROTH:
Q. Right. But you understand that there are doctors who have been criminally convicted for illegally prescribing opioid products?
A. I -- yes, I do know there have

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been some prosecutions.
Q. And you don't have any variable in your model to account for that?
A. I do not account for that in my model, no.
Q. You don't have any variable in your model to account for diversion of lawfully prescribed drugs to someone other than the intended user?
MR. SOBOL: Objection to the form.
A. Just to be clear, when -- when thinking about what to put in a model, one reason we might do it is we want to say this is something separate from the variable of interest.
But if, in fact, the allegedly unlawful marketing caused diversion, then it would not be appropriate to pull it out from the model.
BY MR. ROTH:
Q. Right. But you could conceive of a set of facts where diversion occurs in the setting of perfectly lawful marketing and prescribing?

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A. Well, my model is currently agnostic as to whether the prescriptions caused by the unlawful conduct were diverted or not. It seems to me that it's a legal question about, you know, whether it would be appropriate to separately identify those.
As we started out our conversation today, it makes sense to me as an economist that what -- whatever happened with those prescriptions after they left the pharmacy, the fact that they generated profits for the defendants is a reasonable basis for recovery, again, on the notion that recovery is intended to deter this kind of conduct in the future.
Q. Does your direct model have any variable for formulary placement status?
A. It does not.
Q. Your direct model does not have any variable for prescription drug coverage?
A. As we discussed earlier, these are not factors that I would expect to be changing over time in a way that would predict the sales of opiates as a class, so if there are formulary changes, that may

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result in more generics, more of the preferred brand versus the nonpreferred brand. I don't believe that those are appropriately captured in a model like this.
Q. Okay. Why do you prefer Model B to Model C?
A. In part, because of that counterintuitive effect that we talked about before, with -- now I can't remember if it was oxycodone or hydrocodone.
Q. I think it was the hydrocodone rescheduling.
A. I think it was hydrocodone, yes.
So that suggests to me that that's -- whatever it's doing, it's not picking up what I think it's supposed to be doing.
It makes almost no difference in the predictions, we looked at those charts before, and you can see in the adjusted R-squared there's almost no difference, but it's -- to me it looks like it's not the right way to capture the effect of these events.

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BY MR. ROTH:
Q. And, actually, I think Model C has a slightly higher adjusted R-squared than Model B.
A. Yeah, just to be clear, it's one ten-thousandth of a point.
Q. But it is higher.
A. It is technically higher.
Q. If you were to put more of the events from Figure 5 into what is Model C, would that not be a fairly robust test of the predictiveness of Model B since Model C is really just Model B with the events added?
A. I guess I don't understand your question. If I were to put more events in Model C, would that be another test of Model B?
Q. Right.
A. I think the fact that -- that adding a subset of events that were, you know, displaced over time doesn't change ultimately the predictions in Model B, suggests to me that it's not going to be worthwhile.
And again, the counterintuitive

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coefficient on the hydrocodone rescheduling suggest to me also, as we continue to add more events, we'll get a certain amount of gobbledygook. I mean, that's just going to be true in a time series model.
In any econometric model, the goal is to include the important factors but be as parsimonious as possible. Adding all these events would not be parsimonious.
Q. I think I heard you a minute ago say that you rejected Model C in favor of Model B in part because of the hydrocodone rescheduling. Is there anything else that led you to make the decision that Model B was preferred?
A. It adds almost nothing.
Q. So it's really a function of almost essentially the same R-squared and you get this wonky result with hydrocodone's rescheduling that leads you to prefer Model B?
MR. SOBOL: Objection, asked and answered.
A. That's -- yes, that is in effect correct. I look at the two models, I

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see that they give almost the same predictions, the same actual predicted and but-for predicted, and it seems to me that Model C is not well specified in those five events, that they don't seem to work in the way that they're specified there, which is that they start happening at a point in time.
BY MR. ROTH:
Q. And yet, your breaks also occur at a point in time?
MR. SOBOL: Objection.
A. The breaks are doing something entirely different because they're interacting with promotion. They're saying, you know, we've estimated this underlying effectiveness of promotion and does that relationship shift at a point in time.
BY MR. ROTH:
Q. Okay. Model B suggests an R-squared of 99.36%.
A. Yes.
Q. So your model explains more than 99% of the variation in MMEs with promotion?
A. That's correct, and price.

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Q. So less than 1% of opioid MMEs are explained by anything but price and promotion?
A. That's correct.
Q. And you conclude that the predictive power of Model B is shown to be quite good?
A. Yes.
Q. Have you tried running your model removing promotion and just having price in the model?
A. I have not.
Q. If it showed negative MMEs, what would that mean for your model?
A. If we're removing promotion and -- I mean, I guess as we talked about in looking at Model A, it would suggest that there was something that's missing from the model. When we looked at the but-for MMEs as negative, that clearly it is not doing a good job of predicting the real world in which there were positive MMEs.
Q. What is overfitting?
A. Overfitting is when you include factors in the model such that you perfectly

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predict the dependent variable, that you've saturated the model, which is why I don't add more events to this model, where it's already high. Having an adjusted R-squared as high as we do in this case in a time series model is quite common.

Q. How do you tell to see if a model is overfit?

A. I don't actually, as I sit here, recall the specific test for overfitting, but usually it's about predicting out of sample and looking at how well the model forecasts.

Q. How does the R-squared of your model in this case compare to R-squareds you have from other models you've done of promotion against sales?

A. I don't recall specifically, but I think we probably have a few in front of us that we could look at.

Q. Yeah. I mean, does 99.36 strike you as one of the higher R-squareds you've had or are all of your models perfect in their predictions --

A. Model A has an R-squared of

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88 -- well, 87.99, the adjusted R-squared. So we have a range here. Again, time series models do typically have very high R-squareds. I don't know what they've been in other models.

As we talked about before, this is unlike the model, for example, that we did in the Kaiser Family Foundation report where we're looking at a couple of years for about 25 drugs and exploiting both time series and cross-sectional variation.

Q. You understand from the literature that a very high R-squared in the presence of substantial unmodeled autocorrelation can be an issue?

A. I think we've already talked about the error structure here, and my understanding is that my team looked at that early on and concluded that it was not a problem here.

Q. Who from your team did that work?

A. That would be Forrest McCluer.

Q. And what specifically did Mr. McCluer do to test for autocorrelation?

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A. Well, as we were talking before, he was looking at the correlation over time of the errors in the model.

Q. And did you see the results of his work?

A. I did not see the results specifically, no.

Q. Is your direct model a linear model or a nonlinear model?

A. Well, it's nonlinear because of the depreciation rate. It is effectively run using ordinary linear -- ordinary least squares, but it's nonlinear because of the interaction of the depreciation rate.

Q. Is R-squared an appropriate measure for nonlinear models in econometrics?

A. The adjusted R-squared that we report here is appropriate for this model.

Q. Okay. Let me mark as Exhibit 18 an article from Spiess and Neumeyer, An evaluation of R-squared as an inadequate measure for nonlinear models in pharmacological and biochemical research.

(Whereupon, Deposition Exhibit Rosenthal-18, 2010 Spiess and Neumeyer

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Publication, was marked for identification.)

BY MR. ROTH:

Q. Do you see that?

A. I do.

Q. The title sounds pretty relevant.

Were you aware of this paper?

A. Not specifically.

Q. Okay. So this is a 2010 paper in BMC Pharmacology. It looks like Spiess and -- is from the Department of Andrology at the University Hospital Hamburg-Eppendorf in Germany.

Do you see that?

A. I don't actually see where the authors --

Q. I'm looking at the footnote.

A. Uh-huh, yeah.

Q. Okay. So at page 1, at the very bottom of the first column under Background, it says: Although it is known now for some time that R-squared is an inadequate measure for nonlinear regression, many scientifics and also reviewers insist on

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it being supplied in papers dealing with nonlinear data analysis.
Do you see that?
A. Yes.
Q. And then if you flip to page 8, under their plotted diagrams in Figure 3, I'm in the left column.
A. Left column, and the notes under --
Q. Under the chart.
A. Yep.
Q. The end of the first paragraph says: Consequently, and based on the analysis of a sigmoidal nonlinear setup as described here, we feel compelled to give the following summary: 1, The use of highly inferior nonlinear models is reflected only in the third or fourth decimal place of R-squared, and thus the description of single models when using R-squared is not meaningful, as this measure tends to be uniformly high when a set of models is inspected.
Do you see that?
A. I do.

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Q. And the authors say: This has also been noted by others, and they have a note 20.
Do you see that? And there's a Zeng study from 2008 that they cite?
A. Yes.
Q. And are you familiar with that study?
A. No, I'm not familiar with that study. Ultimately, the -- whether you rely on the R-squared statistic or not, and I -- I don't know honestly if this applies to the particular nonlinear model that I'm using. These are obviously full-time statisticians.
But in my experience, the adjusted R-squared is very frequently used for these kinds of models, but ultimately, you looked at the data; you can see the predictions versus the underlying data, and we have a very good sense of how well the model actually fits the data.
Q. And what measure do you have of how well the model fits the data other than the R-squared statistic?
A. I imagine, so they are talking

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about using other criterion, the AIC and other criteria, that those model criteria, AIC and BIC, which are other model criteria that are frequently output by these kinds of programs. I imagine that they would likely agree.
I can't say for sure. I haven't calculated them or looked at them myself, but I think the fact that they believe the R-squared statistic itself is not meaningful does not suggest that there's no information from the model fit data that I've looked at.
Q. And there's no AIC or BIC statistic in your report.
A. I don't think it's in the output, no. It wasn't in what we looked at, was it?
Q. No. I just looked at the tables and didn't see it.
A. Yeah.
Q. Okay. Turning to Table 2 of your report, which is on page 51.
A. Yes.
Q. So this table is your

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calculation of MMEs attributable to defendants' promotion from Model B; is that right?
A. That's correct.
Q. And so between 1995 and 2018, you calculate a percentage of MMEs that were attributed to defendants' promotion in each year, right?
A. I do.
Q. And it starts with only 5.5% in 1995.
Do you see that?
A. Yes.
MR. SOBOL: Objection to form.
A. Yes, the number is 5.5% in 1995.
BY MR. ROTH:
Q. And then it increases consistently, with the exception, I think, of 2005 and 2006 in every year after that.
A. That is correct.
Q. And in 2005-2006, for the record, it's 50.8 and 50.7%, so it stays relatively flat in those years.
A. Yes, that's correct.

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Q. So despite the volume of MMEs going down, your model reflects that the MMEs attributable to defendants' promotion increases over time?
A. Just to be clear, what this is saying is the share of MMEs, and so that makes perfect sense, that as the volume is going down over time, that the share could well be increasing.
Q. To what do you attribute the increasing percentage attributable to defendants' promotion over time?
MR. SOBOL: Objection.
A. I think it would make sense to interpret that. Of course, it is the result of the analysis, but if we think about the notion that defendants' detailing and other conduct cumulatively affected prescribing patterns, that would suggest that it would be increasing.
BY MR. ROTH:
Q. It's the depreciation rate that's driving it up, in part?
MR. SOBOL: Objection, form.
A. No, it's the model results that

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are driving it up. Again, the fact that the stock of promotion is increasing because of the negative depreciation rate in Model B doesn't mean necessarily that the effect has to be increasing in that first part of -- of before we allow the promotional effectiveness to deteriorate. That would be true because there's a positive coefficient on promotion, and so it's simply true over time that that promotion is having a larger and larger effect.
BY MR. ROTH:
Q. Have you run Model B with the same period interval breaks with a positive depreciation rate to see how that would affect things?
MR. SOBOL: Objection, asked and answered.
A. I believe you asked me that earlier, and I said no.
BY MR. ROTH:
Q. I asked a lot of questions. I can't remember all of them. I'm sorry.
Let's turn to paragraph 76 of your report, and I want to talk about your

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sensitivity with respect to specific defendants.
A. Okay.
Q. You started talking about this this morning, this is Attachment C.
A. That's right.
Q. And eventually it outputs into Table 3, which is on the page.
A. Yes.
Q. So in paragraph 76, you say: As noted in my assignment, I have examined the sensitivity of my calculations of impact to the inclusion or exclusion of particularly -- start over. Strike that.
As noted in my assignment, I have examined the sensitivity of my calculations of impact to the inclusion or exclusion of particular defendants' promotional efforts in the construction of my but-for scenario.
Do you say that in paragraph 76?
A. I do.
Q. And then you say: In the first row of Table 3, I show that impact of

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manufacturer misconduct on MMEs from 1995 to 2018 with a but-for scenario that assumes none of the defendants' marketing was lawful.
Do you see that?
A. I do. I was just thinking, because this is in the errata, if we talk about specific numbers, can we remember to bring that up?
Q. I was going to go there next. So you actually --
A. Okay. I was trying to find it.
Q. You gave us the errata on Thursday.
A. Yes.
Q. One of your errata was actually saying that something you previously said was not statistically significant is statistically significant.
A. That's right.
Q. And another errata is changing the percentages in Table 3.
A. Yes.
Q. Those are fairly immaterial errata.
MR. SOBOL: Objection.

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A. I would disagree, although I don't want to use the word "material" because that may mean something different to you and to me, but the first one relates to the joint significance of those five events.

It doesn't change my opinion about the counterintuitive effect of that hydrocodone event and my general sense that they're not picking up something in the data that's important because they don't really change the results.

So that doesn't change my opinion, so that doesn't change my conclusions.

This was a miscalculation. Table 3 was inadvertently calculated including 1993 and 1994 in which the actual and but-for worlds are exactly the same, and so those zeros basically were averaged in there.

So the underlying data, they're exactly the same as they were originally submitted, it's just the Table 3 summary is updated.

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BY MR. ROTH:

Q. And when you updated the Table 3 summary, the defendants' share in your model actually increased?

A. Yes, again, because it takes those two years that are not in question out of the analysis.

Q. Why were those two years in there to begin with? Had you modeled it going back to '93 instead of '95?

A. In all of our models we go back to '93. As I mentioned earlier, to estimate the model as accurately as possible, we used all the data that we could, and so again, we allow for -- we look at the promotion that was happening before the alleged misconduct.

Q. And you decided to estimate the harms from '95 forward at the instruction of counsel, correct?

A. That's because I understand, as we talked about, again, earlier this morning, that counsel intend to prove that the misconduct began in 1995.

Q. Okay. So the difference between each manufacturer's percentage in

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Table 3 and the baseline is the percent of MMEs you attribute to that manufacturer; is that right?

A. To their promotion.

Q. And let's just take a step back.

How was that done? How did you attribute promotion to a particular manufacturer defendant?

A. So in the IMS data, we can see who's promoting for what product, so that's the sort of complex nature of the tables in the back. So we can see when, for example, there were other manufacturers promoting for one of the defendants, and we can make those cross-walks.

Q. And the IMS data doesn't always consistently put drugs in the same manufacturer's bucket; is that right?

MR. SOBOL: Objection.

A. I'm not sure what you mean by that. Would you explain?

BY MR. ROTH:

Q. We can look at something that explains it.

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A. Sure.

Q. But so I understand mechanically how Table 3 works, the baseline is when you take all MMEs that you claim are attributable to defendants collectively. That's the baseline?

A. Yes. So that was where I realized that there was a mistake in the table is that that baseline number is the same as the summary number in Table 2.

Q. So it's 44.9%?

A. That's correct.

Q. Okay. And then each line item is essentially calculating the baseline percentage against the percent that you attribute to that specific manufacturer?

MR. SOBOL: Objection.

A. I'm not sure, but you may be right, but I wouldn't have said it that way.

BY MR. ROTH:

Q. How would you say it? Just explain what each line is.

A. Each line item has a particular defendant named in it, and in the number calculated to the right of that, I rerun the

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but-for scenario, but I allow that defendant their promotion to stay in the but-for world, so that's by way of saying, no, that things would not have been different for this defendant. That is exactly -- it was appropriate. It was not -- not shown to be unlawful, whatever.

Q. Right. So you assumed that a particular defendant's promotion is lawful, and then rerun your but-for world?

MR. SOBOL: Objection.

A. That is certainly the way I framed it, but presumed that for whatever reason, we are not going to recover related to that promotion, and so it stays in the but-for world instead of being backed out like the others.

BY MR. ROTH:

Q. So in order to allocate MMEs among the individual defendants and non-defendants, you said you looked at IMS data. Can you be more specific about which specific IMS data? Was it the NPA data or the IPS data or both?

A. I -- I don't think I said what

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you said I said. But just to be clear, for this analysis, what we're backing out is promotion, detailing, not MMEs. We're backing out the detailing, and then whatever MMEs flow from that, that comes out in the analysis.

Q. Okay. So what is the data source for the detailing?

A. The Integrated Promotional Services.

Q. So the IPS?

A. The IPS.

Q. So you did not consider the NPA for that allocation?

A. No, because that was not the purpose of the analysis. The purpose of the analysis was to change what we're considering to be the challenged conduct, and then the model tells us how many MMEs flowed from that.

Q. Did anyone check whether the IPS data was corroborated by the NPA data with respect to how it allocated drugs?

MR. SOBOL: Objection.

A. Well, I think that notion

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doesn't make a lot of sense. There are drugs that are sold and not promoted. So there's -- there's not a one-to-one relationship.

BY MR. ROTH:

Q. Even though 99.6% of the world is explained by promotion and price, drugs get sold without being promoted?

MR. SOBOL: Objection.

A. Those two things are not at all in contradiction. Again, remember, we're looking at an aggregate market here and we're talking about the aggregate market growth. And so there are explicitly spillover effects anticipated here.

BY MR. ROTH:

Q. Are you aware of for which drugs specifically plaintiffs have alleged unlawful marketing?

A. Yes. I mean, could I sit here and rattle them off? No. They're -- but I'm happy to go through Table C with you.

Q. Well, let me ask you that.

Did you go through every drug on Table C to make sure that there was an

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allegation that with respect to that drug, something unlawful occurred?

MR. SOBOL: Objection.

A. I received my instructions from counsel about what promotion to consider unlawful, and that was designated by defendant rather than by drug. And so I confirmed with counsel all of the lists in Table C. So that's my understanding, that these are the correct -- the correct drugs and defendants to be including in my analysis.

BY MR. ROTH:

Q. So there could be drugs on Table C for which counsel will present no evidence of unlawful marketing?

MR. SOBOL: Objection.

A. I guess I don't know one way or the other.

BY MR. ROTH:

Q. If it were the case that there are drugs on Table C for which no evidence of unlawful marketing is presented, you would agree that you should then shift that drug to the but-for side of the equation?

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MR. SOBOL: Objection.
A. Well, I'm not a lawyer, so I really don't -- I don't know how that liability will work, if it's drug by drug or defendant by defendant. I do not honestly know.
As we talked about before and as you can see here, I have the ability to back out drugs as well as defendants, but I -- I haven't anticipated that.
BY MR. ROTH:
Q. Okay. And I think we spoke about this a little earlier, but you know there's a difference between Schedule II and Schedule III drugs under the Controlled Substances Act?
A. I do.
Q. And you are aware that the DEA has changed the classification of certain drugs over time because we'd talked about, I think, hydrocodone?
A. Yes. Yes, I'm aware of that.
Q. And I think you said this, but just to confirm, you didn't consider that issue in determining how to allocate

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detailing contacts for drugs that later became Schedule II but previously were Schedule III at the time of detailing?
A. Well, I would say I did consider it, and in consultation with counsel, I left -- I treated those drugs as if they were Schedule II for the entire time period. That was an explicit assumption.
Q. Okay. And what was that assumption based on?
A. Instruction from counsel.
Q. Are you aware that Dr. Perri opines on specific promotional efforts employed by the manufacturer defendants that he claims were unlawful?
A. I have read Dr. Perri's report. I'm aware that he opines on some specific kinds of activities, yes.
Q. Have you read Dr. Egilman's report?
A. I have not.
MR. SOBOL: Who has?
BY MR. ROTH:
Q. Who prepared the tables in Appendix C that assigned the particular drugs

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to particular defendants?
A. Forrest McCluer.
Q. Do you know how he determined in the first instance who was a defendant and who was a non-defendant?
A. In consultation with counsel.
Q. Based on instruction from counsel?
A. I guess that's right. I mean, certainly it wasn't his opinion about who was a defendant. There were some questions related to changes in ownership that required some digging, and Forrest may have contributed to the conversation, but ultimately, counsel determined who was a defendant and a non-defendant.
Q. Were you involved in those decisions?
A. Not explicitly, no.
Q. How did Mr. McCluer conclude whether an entity that is not a named defendant in the lawsuit was affiliated with a defendant for the purposes of your report?
A. In this conversation with counsel, he asked counsel to instruct.

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Q. How did you allocate prescriptions among the named defendants once those defendants were established? Was it based on the IPS data? We're mixing things, so let me back up a step.
A. Yes.
MR. SOBOL: Yeah, you are.
BY MR. ROTH:
Q. Did you allocate prescriptions among the named defendants, or is it your testimony your model only allocates the detailing contacts among the named defendants?
MR. SOBOL: Objection. You mean promotions, I think.
MR. ROTH: Detailing and promotion are the same thing in her report. But let me reask the question so we have a clean record.
MR. SOBOL: Sorry.
BY MR. ROTH:
Q. Did you allocate prescriptions among the named defendants or does your model only allocate the detailing contacts among the named defendants?

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A. Well, if you look at Table C.2, I do characterize by defendant and by drug, MMEs and extended units. So I don't know exactly what you mean by allocate. Because my model is aggregate, I don't have to allocate MMEs. I am summing up detailing for the defendants versus non-defendants, but these tables summarize the data from the NPA which give you extended units, which we then convert to MMEs.

Q. Okay. So I misunderstood you before.

A. Yeah.

Q. You allocated the detailing contacts using the IPS data, but then you did take from the NPA data the extended units and the MMEs for the drugs?

MR. SOBOL: Objection.

A. Yes. I'm sorry if you were confused about that. The NPA is the sales data, the left-hand side variable. The IPS is the promotional data, the right-hand side variable.

BY MR. ROTH:

Q. Okay. So for the sales data

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for the MMEs, are you saying you didn't have to allocate because you just put the same MMEs for the whole class in every line, or how -- how do the MMEs, for example, for Abstral, the first drug on the list, compare to the MMEs for other products in that class?

A. Well, you can see right here -- I've lost the first page, but to the right -- if you wanted to go to the beginning, to Table C.1, which is a little bit easier to read.

Q. I'm there.

A. You can see MMEs and extended units for Abstral.

Q. So this is just taken straight from the data. This is the way the NPA data is, it's by drug and it contains the MMEs and the prescriptions?

MR. SOBOL: Objection.

A. No. The NPA data contain the extended units and prescriptions. The MMEs are calculated using the multipliers we talked about from the CDC.

BY MR. ROTH:

Q. Got it. That's a good

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clarification.

So the NPA contains the extended units by drug?

A. Yes. I believe it's actually by NDC, and we rolled them up to drug.

Q. Okay. And you rolled them up to drug. Then in C.2 you associate the drugs with defendant or non-defendant?

A. I do.

Q. So how was that determination made?

A. In consultation with counsel and in the IMS data, so the IMS data automatically say who the manufacturer is, but the IMS data have no memory, so if Actavis bought a company yesterday, it's considered an Actavis drug going back in time.

And so considerable work was undertaken to examine the -- as we might call it, the genealogy of these drugs.

Q. And who undertook the work to examine the genealogy of the drugs?

A. Well, Forrest provided the data that we have, as I mentioned earlier, and

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worked with counsel.

Q. And what did you do to verify that Mr. McCluer and counsel's allocation of the genealogy of the drugs was construct?

A. I understand the process they went through, for example, using public documents about acquisitions. I did not independently verify those allocations.

Q. Okay. We'll do a couple with public documents and see how you do.

A. Okay. Good.

Q. Hopefully you had them do a sample or two for you, no?

A. I certainly looked at what their process was. There are a lot of moving parts.

(Whereupon, Deposition Exhibit Rosenthal-19, Kadian Defendant/Non-Defendant Spreadsheet, was marked for identification.)

BY MR. ROTH:

Q. Okay. So I want to hand you what I'll mark as Exhibit 19, which I will represent to you is your backup data distilled down for the drug Kadian.

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A. Excellent.
Q. And do you recognize this data or Excel format or did you not review these sorts of documents with the team?
A. Well, I recognize the general structure of this file. I couldn't tell you one way or another if I've seen this exact file.
Q. Okay. So there's a column that says def_status. Do you see that?
A. I do.
Q. And it says Non or Def.
A. Yep.
Q. And we can presume what that means, but have you --
A. It means non-defendant or defendant.
Q. And are you speculating as to that or did Forrest tell you that? I mean, how do you know that?
A. Again --
MR. SOBOL: Objection. Just no communications with counsel.
But go ahead.
A. Again, I've -- I know Forrest's

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language around this.
BY MR. ROTH:
Q. Okay. And then there's a column for drug.
Do you see that?
A. Yes.
Q. And then a second column for defendant, but this one will say either non-defendant or it looks like a company name.
Do you see that?
A. Yes.
Q. Then there's a column for marketer. Do you see that?
A. Yes.
Q. And do you know what that is?
A. Yes. As I noted earlier this morning, I'm aware that there are marketing arrangements whereby a third party may market for a particular drug, as AbbVie did for Purdue in the case of OxyContin.
Q. And then the last columns say date, def_contacts and def_cost_of_contacts.
Do you see that?
A. Yes. Those are directly from

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the IPS.
Q. And what are those columns, def_contacts and def_cost_of_contacts representing?
A. The date is the month. It says 1 January, but it is the month of January. Def_contacts is the number of contacts, and then cost_of_contacts is a dollar value that IMS assigns to it.
BY MR. ROTH:
Q. So you had dollar values in the IPS data but you chose not to model that?
A. That's correct.
Q. So if you look at the def_contacts, is this just taken directly from the IPS data without any modification by Mr. McCluer?
A. That's correct.
Q. How do you know that?
A. Well, you put a piece of paper in front of me, I can't a hundred percent guarantee it, but it's my belief that these are exactly the form that the data come from the IPS, so I believe that they are unmodified.

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Q. Sticking with this sheet for Kadian, the first couple of entries are labeled non-defendant.
Do you see that?
A. Yes.
Q. And Alpharma and Faulding are both listed as non-defendant.
Do you see that?
A. Yes.
Q. And then if you go about seven lines down, do you see there's a marketer labeled Purepac.
Do you see that?
A. Yes.
Q. And that's affiliated with defendant Actavis.
Do you see that?
A. I do.
Q. Any idea why Purepac was assigned to Actavis by Mr. McCluer?
A. Again, I was not involved in the individual decisions, so I do not know.
(Whereupon, Deposition Exhibit Rosenthal-20, Alpharma Form 8-K, was marked for identification.)

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BY MR. ROTH:
Q. Okay. I'm going to hand you what I'll mark as Exhibit 20, which is a Form 8-K SEC filing from December 12th, 2001 by Alpharma, Inc.
Do you have --
A. I do. December 12th, 2001. Yes.
Q. And I assume this is the kind of document Mr. McCluer would have been looking at to construct the genealogy of the drugs?
MR. SOBOL: Objection, instruct her not to answer.
MR. ROTH: On what basis?
MR. SOBOL: Because now you're asking about the communications between Mr. McCluer --
MR. ROTH: No, I'm asking what Mr. McCluer looked at.
MR. SOBOL: Let me finish. Let me finish.
MR. ROTH: All right.
MR. SOBOL: You're asking about the communications between Mr. McCluer

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and the lawyers.
MR. ROTH: I'm asking if this is the kind of document Mr. McCluer looked at to make the determination as to whether Kadian should be attributed to Actavis and to do the genealogy work.
MR. SOBOL: Well, then I object because that assumes a fact not in evidence.
MR. ROTH: All right. Let me reask the question so we get a clean Q and A.
BY MR. ROTH:
Q. Is this the kind of document Mr. McCluer would have looked at to reconstruct the genealogy of the drugs in your Table 3?
MR. SOBOL: Objection.
A. Well, first, I just want to be clear that I've characterized what happened. Mr. McCluer was absolutely involved because he had these data and could bring them to counsel.
So I was not suggesting that

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Mr. McCluer was making a determination, so I -- I understand that public documents were a part of what Mr. McCluer had dug out. I don't know what exactly was used to make the determination.
BY MR. ROTH:
Q. You don't know whether Mr. McCluer or counsel made the determination or how it was made?
A. It was made with counsel. That is what I know.
Q. Okay. So let's look at Exhibit 20. So this is a 2001 8-K from Alpharma, Inc.
Do you see that?
A. I do.
Q. And then at the bottom it says Item 2, Acquisition or Disposition of Assets.
Do you see that?
A. Yes.
Q. On December 12th, 2001, Alpharma, Inc. acquired through its wholly owned subsidiary, Oral Pharmaceuticals Acquisition Corp., all of the capital stock of US Oral Pharmaceuticals Pty Limited, which

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owns through subsidiaries the generic oral solid dose pharmaceutical businesses of FH Faulding & Company Limited (Faulding) from Mayne Nickless Limited for $660 million.
Do you see that?
A. Yes.
Q. And then in the next paragraph down, it says Alpharma's acquisition of the Oral Pharmaceuticals Business includes the operations of Purepac Pharmaceuticals and Faulding Laboratories in the United States.
Do you see that?
A. Yes.
Q. So going back to Exhibit 19, for some reason or another, the decision was made that Alpharma and Faulding were non-defendants, but the other acquired subsidiary, Purepac, is attributed to Actavis.
A. I -- this is the first that I've dug into a specific issue like this, so I can't say as I'm sitting here that there's some other piece of information that's relevant. I really don't know.
Q. And you don't know whether

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there are other issues like this with your Table 3?
MR. SOBOL: Objection.
A. Again, I rely on counsel for the identification of the appropriate entities to be included in the defendant group.
BY MR. ROTH:
Q. And if counsel was wrong in allocating entities to defendant groups, then your Table 3 would reflect that wrong input from counsel in allocating causation to the manufacturer defendants?
MR. SOBOL: Objection.
A. If there were a misallocation, it could certainly be corrected and Table 3 rerun. Table 3 is just a product. It's a simulation to show the capabilities. If there's an underlying issue -- and again, I don't know that there is one -- it could be altered and changed.
(Whereupon, Deposition Exhibit Rosenthal-21, Bloomberg Company Overview of Purepac Pharmaceutical Holdings Inc., was marked for

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identification.)
BY MR. ROTH:
Q. Okay. Let me mark as Exhibit 21 information from Bloomberg on Purepac. Do you have that?
A. Yes, let's see.
Q. It says: Purepac Pharmaceutical Holdings operates as a subsidiary of Pfizer Inc.
A. Yes, I'm trying to figure out what date. I see the date on -- this just might be when it was printed, though, so what's the date of this fact?
Q. This was printed off on April 14th, 2019 from Bloomberg, so two weeks old.
A. Right, right, I understand. I just wasn't sure what time period you were going to ask me be about since -- this may be current, but I don't -- again, because things change, I don't know.
Q. Well, that's a great point. So what matters for Table 3? Are you looking at current affiliation or past affiliation or affiliation at the time of detailing? What

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did Mr. McCluer do?
A. Again, on instructions from counsel, as when a company acquires -- when a defendant acquires a drug that was marketed by another defendant earlier, those -- that detailing carries forward to the acquiring -- the assumption there is that the acquiring entity acquires liability for those effects.
Again, that's something that's been explicit and so those kinds of changes work that way.
Q. And that was an instruction from counsel as opposed to an analysis of the asset purchase agreement or some other mechanism?
A. This was all on instruction from counsel.
Q. Back to your tables for a minute. If you look at Table C.6 -- I guess one question: Do you know why C.5 and C.6 have privileged and confidential stamps at the bottom?
A. I don't know. Not being a lawyer, I think we might put it on everything.

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Q. Well, did counsel draft this on their computer or was this something that McCluer did?
A. This is something that we did.
Q. Okay.
MR. SOBOL: It might be because of ARCOS.
BY MR. ROTH:
Q. So if you look at --
A. I love that you think counsel know how to use a spreadsheet.
Q. I do actually. We'll have fun if we get to trial.
A. Okay. Good.
Q. So if you look at Table C.6, the first page starts with Actavis, and tell me when you're there.
A. Yes.
Q. They're not numbered so it's a little hard.
A. I know. Yes, I see Actavis.
Q. Just pivoting back to a conversation we were having earlier. So, for example, oxycodone, it looks like there's 14 contacts that are attributed to Actavis.

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Do you see that?
A. Yes.
Q. Which is zero percent of the contacts because it's obviously lower than one-hundredth of a decimal place of the contacts?
A. Yes.
Q. And still there's 50 trillion MMEs that are associated with oxycodone.
Do you see that?
A. Yes. It's --
Q. Go ahead.
MR. SOBOL: There's no question before you.
A. Yes.
BY MR. ROTH:
Q. Well, and then we can see like in Kadian, you've got 28,274 contacts which is .27%, and that's associated with 13 trillion MMEs, right?
A. Yes.
Q. And you're not drawing any conclusion about the effect of this extremely small percentage of promotion and the number of MMEs prescribed for those drugs, are you?

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A. I think I've been extremely clear that my analysis is an aggregate analysis of the entire opioid class.
Q. So where it says 50 trillion MMEs for oxycodone, what is that number? Is that all generic oxycodone from 1993 to 2018?
A. Sold by Actavis.
Q. Okay. So all oxycodone sold by Actavis based on counsel and Mr. McCluer's assignment of drugs is in the MME column, and there's 14 promotional contacts in the data?
MR. SOBOL: Objection.
A. Well, again, instruction from counsel identified the defendants. You can see here that oxycodone is -- the manufacturer is just Actavis. It seems uncontroversial to me. But yes, there are 50 million MMEs of oxycodone that Actavis sold between 1993 and 2018.
BY MR. ROTH:
Q. So can you tell without digging into the guts of the model what share Actavis is being allocated for its 14 oxycodone contacts in your model?
MR. SOBOL: Objection.

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Objection.
A. Well, you can see it rounded here to two decimal places. The share of contacts is obviously de minimis.
BY MR. ROTH:
Q. But in terms of the way the shares work in your Table 3, are you looking at percent contacts to come up with that number? You're not; you're doing a revised but-for analysis.
MR. SOBOL: Objection.
A. Yes, but the two things are not disconnected. So the way I construct Table 3, as I mentioned before, is not allocating on the basis of MMEs. It's about rerunning the but-for model and altering the inputs in terms of detailing.
So the 14 contacts for Actavis are backed out when I back Actavis out of the model in Table 3, so that all of the contacts that you see here associated with Actavis, that is what gets backed out of the model.
BY MR. ROTH:
Q. So the 8.47% of promotional contacts?

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A. 8.47%, yes.
Q. So how is that resulting in an overall allocation in Table 3 of 37%?
MR. SOBOL: Objection.
A. 37% -- well, I'm sorry. I'm afraid you misunderstand Table 3. So let me go back and explain Table 3 again.
So Table 3 starts out with the same aggregate impact measure that I calculate in Table 2, right, so that's the -- if all defendant promotion did not occur, here's what percent of units would not have been sold.
And then in Table 3, then I say, okay, well, what if, in fact, the 8.47% of detailing that Actavis was responsible for according to my analysis -- what if that's actually -- that doesn't get affected. That stays in the model. Then I run another prediction. These are econometric predictions based on Model B, and so the 30 whatever percent, 37.0%, now that's the aggregate percent of all MMEs if Actavis' conduct is no longer subject to recovery.
///

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BY MR. ROTH:
Q. So to figure out what percentage of causation each manufacturer's having, you actually have to subtract the percentage that you come up with from that analysis from the baseline?
MR. SOBOL: Objection, mischaracterizes the testimony.
A. If you wanted to know how much -- how many MMEs Actavis' conduct specifically caused in the market overall, you would subtract those two numbers.
BY MR. ROTH:
Q. So you would get 7.9%, which is close to the 8.4% of promotional contacts?
MR. SOBOL: Objection.
A. That's correct.
BY MR. ROTH:
Q. So essentially -- and we can do this defendant by defendant, but it looks like your allocations are just mirroring how much each of these defendants promoted?
MR. SOBOL: Objection.
A. Well, they are not, but -- but it should be obvious that because the

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challenged conduct is promotion, that if we look at taking defendants out of the impact analysis, that the results would be proportional to promotion, because that's the thing that's being challenged.
BY MR. ROTH:
Q. So whoever has the most detailing contacts in the IPS data is going to get the highest share under your Table 3?
MR. SOBOL: Objection.
A. Well, again, Table 3 is not framed or interpreted as telling you how to allocate damages. It is intended for the court to see, A, that it's possible to move defendants in and out of the analysis, and, B, what those effects would be.
Whether or not damages are allocated on the same basis, that is something about which I know nothing.
BY MR. ROTH:
Q. Okay. So we talked about allocating the detailing contacts, and I assume the questions I asked you about the process for doing that would be true whether we're talking about between defendants or

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between defendants or non-defendants, it was Mr. McCluer with instruction from counsel reviewing the sort of documents we just reviewed here today?
MR. SOBOL: Objection. What's the question?
A. The --
MR. SOBOL: No, I don't know what the question is. Is there a question? Or you want to just say "correct" at the end?
MR. ROTH: I mean, come on. All right.
BY MR. ROTH:
Q. I asked you questions about how detailing contacts were allocated. Is the process you described the same whether we're talking about allocating among the defendants or between the defendants and non-defendants?
A. The process of identifying what -- in effect, what contacts should be assigned to defendants was with counsel, and it was ultimately counsel's advice. Mr. McCluer assisted because he had the granular data, but ultimately, the

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identification -- I mean, I'm not sure why it's different to say the identification of what pieces of -- what products belong with what defendants and what products belong to non-defendants. That's all one process.
Q. Okay. How does your model allocate generic drugs?
MR. SOBOL: Objection.
BY MR. ROTH:
Q. The same way as we just discussed?
MR. SOBOL: Objection.
A. I don't know what you mean by allocate. My model measures the aggregate impact of the challenged --
BY MR. ROTH:
Q. I should say it differently. How does Table C identify and associate generic drugs with manufacturers?
MR. SOBOL: Objection.
A. Table C, I mean, the process for identifying the manufacturers and the drugs is the same for generics as it is for brand name drugs. Those generic manufacturers are identified in the IPS --

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sorry, in both the IPS and the NPA data.
BY MR. ROTH:
Q. And then looking back on Exhibit 19, you reference that the marketers were associated with entities pursuant to marketing arrangements. What did you review on that score?
A. I relied on counsel for that information.
MR. ROTH: I tell you what, why don't we take five more minutes, because I think it would benefit for streamlining.
THE WITNESS: Okay.
THE VIDEOGRAPHER: The time is 4:57 p.m. We're now off the record.
(Recess taken, 4:57 p.m. to 5:15 p.m.)
THE VIDEOGRAPHER: The time is 5:15 p.m. We're back on the record.
BY MR. ROTH:
Q. To close the loop on this, Professor Rosenthal, Table 3 is the output of Appendix C and the way that promotional visits and MMEs are affiliated with the

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defendants or non-defendants; is that right?
MR. SOBOL: Objection.
A. I guess I wouldn't say that exactly. Table C reflects the underlying data structure that allows us to parse defendants individually and collectively from non-defendants in the promotional data.
Table 3 then relies on that structure to produce alternative but-for percentages.
BY MR. ROTH:
Q. The purpose of putting Table C together was to create Table 3?
MR. SOBOL: Objection.
A. I'm not sure that was its sole purpose. It was to be transparent about how we are allocating drugs and their associated promotion to defendants.
BY MR. ROTH:
Q. Table 3 does not allow for a defendant-specific breakdown of the effect of that defendant's promotion, correct?
MR. SOBOL: Objection.
A. Table 3 provides an aggregate measure of impact associated with defendants'

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promotion; it does not disaggregate that across sales.
BY MR. ROTH:
Q. And I think you said earlier, for that you would have to do a disaggregated model, and that's not something you were asked to do, nor something you did?
MR. SOBOL: Objection, form, mischaracterizes the prior testimony.
MR. ROTH: Okay. Let me try it again.
BY MR. ROTH:
Q. In order to analyze the effect of a specific defendant's promotion, you would need to look at a defendant-specific model to correlate its promotion to MMEs?
MR. SOBOL: Objection, mischaracterizes prior testimony.
A. Well, I don't think so. What I have done, as you know, in the aggregate is to look at all promotion and the extent to which it impacted all sales.
And then in Table 3, the only thing I'm trying to do is to identify if we moved some set of promotion from the okay

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column -- from the not okay column back into the okay column, how that would affect my aggregate impact.
So I am looking discretely at defendants' promotion. But because I'm interested in impact, whether or not it was increasing my sales or increasing your sales, I have, appropriate to my assignment, included both of those things in that impact analysis. I have not been asked anywhere to calculate the effect only on own sales.
BY MR. ROTH:
Q. Table 3 allows you to assess the impact of an individual defendant's promotional contacts on the aggregate promotion and aggregate MMEs?
MR. SOBOL: Objection, asked and answered.
A. Yes, that's correct. And just to be clear, as we talked about before, the purpose of Table 3 is not to allocate to defendants. I don't know how damages ultimately will be allocated, but to demonstrate that I could remove the conduct of one of the defendants and still calculate

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aggregate impact.
BY MR. ROTH:
Q. And, in fact, Table 3 does not even allow you to isolate the impact of an individual defendant's promotion alone on the aggregate; it simply shows you the proportion of that individual defendant's promotion to the aggregate?
MR. SOBOL: Objection, form, asked and answered.
A. I don't think that's correct. As we talked about before, this is not the purpose of the table. But if you were to look at the but-for percentage including Purdue versus the but-for percentage excluding Purdue, you would see the increment that is due to Purdue's conduct.
BY MR. ROTH:
Q. And that's essentially based on Purdue's share of the promotional contacts in the data?
MR. SOBOL: Objection, asked and answered.
A. That is the way the aggregate model works, yes. It looks at all detailing

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and their effect on all sales.
BY MR. ROTH:
Q. It's akin to a market share analysis on the promotional data and the number of contacts a given defendant has?
MR. SOBOL: Objection, form, asked and answered.
A. Well, it's not strictly speaking because the model has this time series structure that marketing that occurs at one point in time is not the same as marketing that occurs at a different point in time. So it's not, strictly speaking, proportional.
BY MR. ROTH:
Q. But it is essentially a market share analysis of each defendant's share of contacts as modified by the time series structure that you've imposed that we talked about earlier today?
MR. SOBOL: Objection.
A. I just can't agree with that statement. It's not a market share analysis. It is the result, the output of a time series analysis of the effect of marketing on sales,

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and -- and then I alter a set of underlying assumptions about what is in and what is out.
But it comes out of -- out of this econometric model. It doesn't -- it's not simply a market share analysis.
BY MR. ROTH:
Q. If you took all of the defendants out of the model except for one, what would the result of your table be?
MR. SOBOL: Objection.
A. Another number. I haven't done that.
BY MR. ROTH:
Q. I mean, would that defendant not just get the entire 43%, or would there be some other...
A. No, that's not the way the model works.
MR. SOBOL: Objection.
BY MR. ROTH:
Q. Okay. But it wouldn't be -- that would not be a defendant-specific model; that would just be isolating how your aggregate model works when you just consider one defendant's promotion?

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A. Well, again, the aggregate model would be the same, and if we said that all the defendants were no longer going to be subject to recovery except one, then we would be left with the -- whatever the effect of that defendant's promotion on sales was.
Q. Have you compared the results of altering your aggregate model using Table 3 on a defendant-by-defendant basis with each defendant's share of promotional contacts in the data?
MR. SOBOL: Objection, asked and answered.
A. Well, I think when you and I were talking before the break, you made some observation, but I have not, no.
BY MR. ROTH:
Q. Okay. When were you retained by the plaintiffs in this case?
A. In the summer. I'm not sure the date on the letter, but in the summer of 2018, sorry, to be clear.
Q. Who was it that retained you?
A. I was retained by co-counsel. There are two Pauls and Joe Rice, and one of

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them is a Hanly, but I can't remember all their names.
Q. Okay. Did you personally draft your expert report?
A. I did.
Q. And did anyone else assist you in the drafting of the report?
A. I had some assistance from my staff, yes.
Q. And you've mentioned your staff. We said that was Greylock. Can you just give us the names of all the people who were on your staff?
A. Sure. Yes, of course. Forrest McCluer, who is the senior economist they mentioned earlier, particularly around the technical aspects of the report. I believe I would have had some assistance, for example, in summarizing the complaint from Renee Rushnawitz.
Q. Can you spell that?
A. Yes, R -- well, Renee, is R-E-N-E-E, and then Rushnawitz, R-U-S-H-N-A-W-I-T-Z.
Q. Okay. Anyone else?

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A. Not that I know of, but there are -- there are junior staff, for example, who work with Forrest and Renee, so I think if you looked, you might see that there were junior staff pulling articles, doing that kind of thing, but not involved in drafting.
Q. So I understand from earlier today and attending their depositions that there was some amount of coordination you did with Professors Cutler, Gruber and McGuire filing these reports; is that right?
A. Yes.
Q. Did you meet with each of the three other professors about your reports in person before March 25th?
A. Yes, we had meetings with counsel.
Q. Do you recall how many meetings you had with one or more of the Professor Cutler group or McGuire try up frustrate prior to March 25th with or without counsel present?
A. I believe there were perhaps four face-to-face meetings from the time I was retained to the filing of the report. It

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may have been five.
Q. And in addition to the four to five face-to-face meetings, did you speak with Professors Cutler, Gruber or McGuire about either your work or their work on this case?
A. We had conference calls with that group and with counsel for a period that were weekly.
Q. And do you recall how long the in-person meetings were?
A. Those in-person meetings I think were -- they were largely half day meetings.
Q. And during those meetings, did you present your analyses to each other on slides or were they just conversations? How did those meetings work?
MR. SOBOL: Just generally, without the content.
A. Generally there were high-level presentations and discussions.
BY MR. ROTH:
Q. And did you discuss with them in general terms the analyses that ultimately

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became the output of your expert report?
A. Yes.
Q. And the models you would run and the approaches you would take?
A. Yes.
Q. And I assume they shared their approaches and models and general report structures with you too?
A. Yes.
Q. Did you review drafts of any of their reports and did they review drafts of your reports?
A. I -- what was the question.
MR. SOBOL: With or without counsel?
A. Review drafts with or without counsel?
MR. SOBOL: Well --
BY MR. ROTH:
Q. Were there drafts reviewed? I know I'm not going to get the drafts. I just want to know if you reviewed each other's drafts?
MR. SOBOL: Sure.
MR. ROTH: And did the realtime

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drop off?
DEFENSE COUNSEL: Ours is working.
MR. ROTH: Never mind. Go ahead.
A. So I did see drafts of at least Cutler and part of McGuire.
BY MR. ROTH:
Q. And did you discuss the regression model approaches that you would each take with each other?
A. We discussed it, our analysis in general, yes.
Q. Do you believe the regression models you used in this case would be publishable?
A. Yes, I do.
Q. What about Professor Cutler's methodology? Do you believe that would be publishable?
A. Yes, I do. It's very similar to other work he has published.
Q. Do you believe that professor Gruber's methodologies would be publishable?
A. Yes, obviously professor

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Gruber's methodology -- it's multiple methodologies it's not one thing, but yes, I believe it would be.
Q. And same question for professor McGuire?
A. Yes, I believe it would be.
Q. I noticed you're charging $825 an hour for your time?
A. Yes, that's correct.
Q. How many hours have you spent to data personally working on this matter?
A. I believe the number is about 300.
Q. And what about your team at Greylock McKinnon? Do you have any sense to as how many hours they've spent?
A. I have not looked at their hours.
Q. I imagine it's been more or less a full-time job for them since July?
A. I think that that is pretty close to true.
Q. And have you or Greylock issued any invoices?
A. Greylock submits those

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invoices. I don't know for sure. I assume that they have submitted invoices.
Q. Do you have any sense as to the overall quantum of how much you have Greylock have charged in fees?
A. No, I do not.
Q. And I assume your work is not contingency fee based in any way?
A. It is not in any way.
Q. Did the plaintiffs replace any reconstructions on cost or the scope of work that you or Greylock was allowed to do?
A. Not to my knowledge, nothing -- nothing in my retention that suggested that, no.
Q. Okay. So we spoke earlier today about a couple of things you're relying on counsel for. One was the assumption that they'll prove all marketing since 1995 is unlawful, correct?
A. Yes.
Q. Another one the construction of table C that allocated promotional contacts from the IPS data to defendants, right?
MR. SOBOL: Objection.

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A. Right, to the extent there's uncertain city there, it's not just the way the data arrive, so yes, that genealogy.
BY MR. ROTH:
Q. Right. So we've got those two things. As sit here right now, is there any other assumption that was given to you by counsel that we haven't talked about yet?
A. Hmm.
MR. SOBOL: On the direct or -- I can't think of anything, but you haven't really --
MR. ROTH: We haven't gone past the direct model yet, that's true.
A. Yeah, it's helpful for me to see my summary.
BY MR. ROTH:
Q. Okay.
MR. SOBOL: She was given the assignment. I'm not trying to coach her.
A. Not that I can think of, as I sit here.
BY MR. ROTH:
Q. Okay. Look at Attachment A

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with me, please, for a minute. And that's the CV that you filed with your report in this case?
A. Yes.
Q. And I assume that is still accurate as of today?
A. It's the most updated one I have. It may -- what is it May there may have been a paper or two that's been published since the CV was finalized.
Q. Okay. Have you published any economic papers related to opioids?
A. I have not.
Q. Have you published any academic papers related to addiction?
A. I have not.
Q. And you've never testified previously on either opioids or addiction, true?
A. I believe that that is true. I'm just trying to think of cases that involved multiple drugs, but I --
Oh, yes, although actually I have to check to see if it's -- if I actually testified in this case. I just want to look

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at that part of my CV. Let's see. Or I could look at the report --
Q. Yeah. Take your time.
A. -- testimony. Yeah, one sec.
(Document review.)
A. This case was a number of years ago, and I just honestly cannot remember if I was ever deposed in it, so I can confirm that offline, but there was another ways that I was retained in that related to an opioid.
BY MR. ROTH:
Q. I tell you what, we can start there tomorrow.
A. Okay.
Q. Have you ever had your opinions excluded or limited by a court?
A. In one case an opinion I offered on ascertainability in a case involving a drug called Wellbutrin XL, my opinion on -- on damages was accepted, by my opinion as it related to ascertainability was deemed to have included some inappropriate legal assumptions, as I understand the judge's opinion in that matter. So yes.
Q. And is that the only one were a

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court limited or excluded your opinions?
A. Yes.
Q. You're not aware of any others as you sit here right now?
A. I'm not aware of any others.
Q. What happened in Celexa and Lexapro?
MR. SOBOL: Objection to form.
A. Again I'm not a lawyer, but I don't think my opinion was excluded.
BY MR. ROTH:
Q. Okay. Is Attachment B to your report a complete list of all of the materials on which you relies to form your opinions in this case?
A. It is.
Q. Did you review any materials that you didn't rely on that aren't included in Attachment B?
A. I may have. It would be hard for me to cross-walk to see things that I reviewed and didn't rely on. My staff certainly reviewed other documents.
Q. How were the depositions that you reviewed -- I think there are seven in

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total -- selected?
A. Yes. I specifically asked counsel -- because as you know in my assignment I was asked to undertake this analysis nationally, I specifically asked counsel to find in their record any testimony relative to the national nature of marketing. It's not something that's easy to find in documents, otherwise.
Q. Got it.
So you received those seven with -- in response to your very specific requests?
A. Yes.
Q. And beyond that, you didn't review any depositions in this case?
A. I don't believe I cite depositions for any other purpose in this case, no.
Q. You list three other expert reports, Schumacher, Perri and Parran.
Do you see that?
A. I do.
Q. Are those the only expert reports that you reviewed before issuing

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yourself. I think you mentioned you might have seen drafts of Cutler, McGuire and Gruber?
A. Yes, but I don't cite to them my report or use them.
Q. Yeah, count rely on them?
A. No.
Q. How did you select the Bates numbered documents that are listed in Attachment B?
A. The Bates number documents were the product of searches that I asked my staff to undertake specifically looking for information on marketing tactics.
One big set of documents that I asked them to find was related to promotional effectiveness, and those documents that talk about the return on investment for marketing expenditures.
So these were basically the result of specific requests I made to my staff and they searched the database themselves.
Q. And did you review all of the documents related on in your Attachment B, or

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did you rely on your staff to do some of that review for you?
A. I reviewed the key segments of all of these documents. Some of the documents are quite long, and I relied on my staff to review the whole documents.
Q. I'd be shocked if you read every one of these in 300 hours?
A. Yes, as I said, some of these documents are very long, and you see that I cite to specific parts of them.
Q. Okay. Look at B8 please which lists the electronic data you relied on.
A. Okay.
Q. So we've talked a lot today about the NPA and the NSP data from IQVIA?
A. Yes.
Q. Sorry.
A. The IPS --
Q. And the NPA and the IPS data.
A. Yes.
Q. But have we not talked about the NSP data. So what is the National Sales Perspective data and how you are relying on that?

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A. I'm trying to think if we actually use the NSP. I know we cite it in our tables. We show it in Table C in order to be able to show wholesale quantities as well. But we actually use the NPA data themselves, you know, essentially they track the same -- the same products at different stages of the supply chain and so I can't recall.
I'd have to actual look carefully through the tables to see if there's any reason that we used the wholesale data. Those are wholesale data.
Q. So the NPA data is the retail data.
A. That's correct.
Q. And the NSP data is the wholesale data?
A. Correct.
Q. Do you know if you did any data cross-walking or review of the two data sources to see how they related to each other?
A. I believe we may have. I don't know -- I don't know if there's -- that's

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what I was trying to remember, if there's anything in my report to that effect. We have used those two datasets very frequently, and they typically are extremely highly correlated. One lags the other, obviously.
MR. SOBOL: Do you mind if I coach him on an irrelevancy right now? No seriously, this might just help you to clean something up.
Do you use NSP for prices?
THE WITNESS: No, I use the NPA for prices.
MR. SOBOL: Okay.
MR. ROTH: Okay.
BY MR. ROTH:
Q. So on the electronic data section, what is this agency for healthcare research quality healthcare cost and utilization project and how do you use that?
A. Sure. That's part of our conversation for tomorrow, I hope. Those data are discharge data that we use to look at the surgical admissions.
Q. In the indirect model?
A. Yeah, in Section X.

Q. And then the bureau of labor statistics that's also used in the indirect model?
A. Yes.
Q. The ARCOS data is in the indirect model. What is this health resources services administration Area Health Resource File?
A. The Area Health Resource File is sort of a metadata file. It includes data from other sources to describe various dimensions of county-level health systems, health measures. So we also used that in the indirect model, and I actually have to look to see if we used in the Section X.
Q. And then what about the CDC surveillance epidemiology and end result dataset?
A. Those data track cancer, cancer epidemiology.
Q. How did you get access to the electronic data that you list in Attachment B?
A. Attachment B includes some publicly available data that anyone can

obtain through the Internet, so that would cover the ARC data, the ASEC data, the SEER results, because we're not getting the SEER microdata; they're aggregated. And certainly the morphine milligram equivalence from the CDC is publicly available data, the Area Health Resource File is publicly available data.

The ARCOS data we obtained through compass lexicon, the IQVIA data counsel purchased on our behalf. They won't sell it to us directly for litigation purposes. They will sell to counsel.

Q. And the --
A. And the INCB are public.
Q. And did you discuss with counsel purchasing any additional IQVIA data than the three set that you analyzed, IPS, NPA or NSP?

MR. SOBOL: I instruct her not to answer.

MR. ROTH: I asked her if she talked about it.

MR. SOBOL: Well, it would carry the implication of the content

of the conversation.
BY MR. ROTH:
Q. Are you aware that you've sells data beyond those three datasets that were purchased?
A. Yes. I am aware they sell other datasets.
Q. Okay. Did you sign any protective orders to get access to the ARCOS data?
A. I did not, no.
Q. And have you signed any data use agreements related to any of the data you looked at?
A. No, but I don't know to what extent, for example, the people who actually have the data have signed those data use agreements so I don't touch the data.
Q. I didn't see any depositions from any of the Cuyahoga or Summit County witnesses on Attachment B, so I assume you didn't review those?
A. I did not.
Q. Did you interview any of the employees with other Summit or Cuyahoga

County?
A. My analysis is a national analysis of the effect of detailing on sales, so interviewing people in the bellwether counties would if the really not make sense as part of what I'm trying to do.
Q. And you didn't rely beyond the seven depositions you list any other depositions in this case related to defendants' marketing efforts?
A. Again, I -- I don't find those to be relevant to the main affect the here, which is a quantitative analysis, and as I noted in my report, economists generally proceed using data to tell what people have done in response to a stimulus rather than by asking them to talk about it.
Q. What did you do to prepare for your deposition today?
A. I reviewed my report, the documents I rely on, including the articles, basically everything in this Attachment B, and I had conversations with counsel.
Q. Okay. Turning back to page 10 of your report, which is the handy summary

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chart?
A. Yes.
Q. Do you do this for every report?
A. I -- it's -- I like a handy summary table. It's something that is -- that we do often in writing federal grants.
Q. I will tell you this is excellent and I'm going to start forcing some of the experts that we have to start doing this?
MR. SOBOL: It's the only thing I understand in the whole report.
MR. ROTH: It's nice, it's a one-pager.
BY MR. ROTH:
Q. So recognizing there's a lot of nuance here, and we've already been through your direct model fairly exhaustively and we'll do the same for the indirect and the Section X analysis tomorrow?
A. Yes.
Q. I want to touch briefly on Section VII for a minute?
A. Okay.

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Q. Okay. So Section VII, you reviewed literature on the marketing of opioids and shared examples from discovery that corroborate the economic theory and evidence on pharmaceutical marketing. That's what you said, right?
A. Yes.
Q. And we've talked about some of that literature here today?
A. We have. We haven't gone into detail on the transfers of value literature related to opioids, but we can.
Q. It's a tomorrow topic, unless you want to stay late?
A. No, that's fine.
Q. But then on the discovery materials, you know, you said you had very specific requests for what you looked at.
Are those the documents you looked at to come to the conclusions you do in Section VII of your report?
A. Yes. The documents that I cite in Section VII -- and again can you tell that my quantification of the effect of promotion on sales doesn't rely on some measure from

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this analysis, but this serves to give some justification for the theory that I'm pursuing that promotion affects sales and that there are multiple mechanisms involved.
So I review them, I would say in Section VII with that purpose in mind, not with the purpose of being exhaustive.
Q. Yeah. And I think you said earlier you're not marketing expert, right?
MR. SOBOL: Objection.
A. I am not here to offer an expert opinion on marketing. I think Dr. Perri does that.
BY MR. ROTH:
Q. Okay. And to the extent that you're offering comments in Section VII.B of your report from paragraphs 43 to 48 related to defendants' marketing documents, that's really did you know with an eye toward corroborating what the economic literature shows in -- as you analyze in Section VI about the relationship between promotion and sales?
A. Again, this was not intended to be an exhaustive analysis, but to show that

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the documents provide examples both of the economic idea that promotion is intended to grow sales and of the multiple marketing mechanisms that defendants use, so it corroborates other -- other ways that I have described the mechanism of interest here.
Q. Beyond reading the documents themselves, what other analytical approach did you take to assessing defendants' materials regarding the effects of promotion?
A. Well, as I just said, I don't use this analysis as an input in a quantitative way to my subsequent analysis. It is relate intended as you would see in any economic paper as a review of the institutional landscape that justifies the particular model and sets up the empirical analysis in a more qualitative way.
Q. It's not really a separate opinion as you bulleted it out. It's more context for the opinions that follow; is that fair?
MR. SOBOL: Objection.
A. Again, I think an institutional analysis is a part of most -- most reports

that I have done looking at impact is describing the environment in the way they describe the broader environment for prescription drugs in the U.S., I think it's important to set that context.

BY MR. ROTH:

Q. But when you're talking about describing the environment, you're limiting yourself to, you know, a subset of documents that you received from discovery. You're not doing any exhaustive review of each defendant east marketing budgets; is that correct?

A. That is correct. That is not any assignment. It's not -- my goal here was not to do an exhaustive analysis of what each defendant was ding. Doing.

Q. In fact, there may be some defendants you don't look at any documents for in Section VII.B?

MR. SOBOL: Objection.

A. Again, I'm hot sure, it was not intended to be exhaustive.

BY MR. ROTH:

Q. Okay. What is confirmation bias?

A. Confirmation bias is a psychological phenomenon, in essence that you find what you expect to find.

Q. And does that exist in economics?

A. It's a known psychological bias. I imagine that economists are humans too.

MR. ROTH: Okay. Why don't we pause on that, take --

THE WITNESS: You're going to end the day there?

MR. ROTH: I might. So let's stop. Give us five to caucus, and that might be a really nice place to end the day.

THE VIDEOGRAPHER: The time is 5:48 p.m. We're off the record.

(Proceedings recessed at 5:48 p.m.)

--o0o--

CERTIFICATE

I, MICHAEL E. MILLER, Fellow of the Academy of Professional Reporters, Registered Diplomate Reporter, Certified Realtime Reporter, Certified Court Reporter and Notary Public, do hereby certify that prior to the commencement of the examination, MEREDITH B. ROSENTHAL, Ph.D. was duly sworn by me to testify to the truth, the whole truth and nothing but the truth.

I DO FURTHER CERTIFY that the foregoing is a verbatim transcript of the testimony as taken stenographically by and before me at the time, place and on the date hereinbefore set forth, to the best of my ability.

I DO FURTHER CERTIFY that pursuant to FRCP Rule 30, signature of the witness was not requested by the witness or other party before the conclusion of the deposition.

I DO FURTHER CERTIFY that I am neither a relative nor employee nor attorney nor counsel of any of the parties to this action, and that I am neither a relative nor employee of such attorney or counsel, and that I am not financially interested in the action.

_____

MICHAEL E. MILLER, FAPR, RDR, CRR
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My Commission Expires: 7/9/2020
Dated: May 6, 2019

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ACKNOWLEDGMENT OF DEPONENT

I, MEREDITH B. ROSENTHAL, Ph.D., do hereby certify that I have read the foregoing pages and that the same is a correct transcription of the answers given by me to the questions therein propounded, except for the corrections or changes in form or substance, if any, noted in the attached Errata Sheet.

_____

MEREDITH B. ROSENTHAL, Ph.D. DATE

Subscribed and sworn to before me this _____ day of _____, 20 _____.

My commission expires: _____

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Notary Public

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